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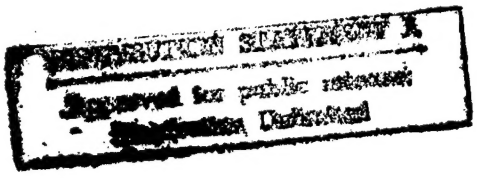
China Report

SCIENCE AND TECHNOLOGY



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CHINA REPORT

SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

JAPAN, PRC TECHNICAL COOPERATION DISCUSSED

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF S&T] in Chinese No 2, 1986 pp 4-6

[Article by Masaru Saito, professor, Chuo University, Japan: "On Technical Cooperation between Japan and China"]

[Text] I. Chinese Technological Strategy

At present, China is heavily engaged in the development of the focal point of its four modernizations. In its strategy to introduce foreign capital, China has strenuously studied the experience of other countries and adopted policies most favorable to China such as various policies about modernization, advanced industrial systems, and management and technology transfers which have nearly all been adopted. However, the focal points are still on the following aspects: 1) transplanting new industries; 2) strengthening management and technology transfers; and 3) doing its best to acquire better results for the four modernizations.

At present, China is trying, through various ways and means, to achieve technology transfers from foreign countries which concentrate not only on the "hardware" but on the "software" as well; they are not only introducing engineering technology but are also interested in the technology of management. They have corrected their shortcoming in the past of looking down on management and are striving to introduce enterprise management from the developed countries under the economic conditions of the free market.

From now on, the focal points of the Chinese technological strategy are: 1) to strive for the development and application of advanced technology in order to serve important areas of national construction. 2) To strengthen technological innovation and create a better structure for industry. 3) To strengthen the introduction, development, and computer technology. 4) To hasten the reform of economic and technology systems and their internationalization. 5) Considering the stage of technological development in China, technology transfers in addition to development based on self-reliance, are still crucial. The really necessary "four transfers" advocated by the Chinese government, which include science and technology transfers, must be carried out from foreign countries to China, from military to civil application, from coastal areas toward the inland, and from

laboratories to the site of production. However, there exist many problems in their realization. 6) In order to put the transferred technology into production, cultivation of talent is also one of the strategies adopted by China at present.

II. Structure of Technology Transfer

In the past few years, the Chinese technology transfer market has been expanding rapidly and according to various patterns. In addition to trade, foreign investment, and technology cooperation, various routes of technology transfer have been opened. For example, the number of technology delegations and the people sent abroad for long- and short-term study increases year after year and this increase has occurred on a nongovernmental basis.

Now, there are graduate students in the big, medium-size, and small enterprises in Japan, and among the countries which have technological cooperation with Japan, China has the greatest participation.

China has introduced a great number of complete sets of equipment, such as complete sets of chemical engineering equipment in Shanghai, Zhejiang, and Tianjin; complete sets of thin-film manufacturing equipment in Gansu, Shanghai, and Tianjin; and complete sets of television set manufacturing equipment. In the technology trade in 1983, Japan has 41 percent of the total amount of the technology introduced into China, the United States has 30 percent, West Germany 9.5 percent, and Italy 6.5 percent.

The characteristics of the market of introducing technology into China are these: 1) speaking in terms of region, the large cities are the focal points and most of the technology introduced is concentrated in Shanghai, Tianjin, Beijing, and the Shenzhen Special Economic Zone; 2) in technology introduction, expenditures on "software" are mounting; and 3) the demand for high technology is increasing.

In addition, various kinds of high technology have been introduced through trade. It is said that the list of the Chinese delegations shopping for technical equipment abroad also includes: 1) satellite navigation systems; 2) tracking radar and laser range finders; 3) night vision equipment; 4) military vehicle simulators; 5) giant lathes for large-caliber cannons; and 7) though the introduction of technology for medium-size and small enterprises is vigorously advocated, the proportion of introduction into large enterprises and military technology has been greatest.

In addition to licensing, China has also introduced a large amount of technology through the purchase of machinery and complete sets of equipment. The major countries exporting technology in China in 1983 are Japan (25.9 percent, occupying first place), the United States (13.0 percent), Hong Kong (8.0 percent), Canada (7.5 percent), and East Germany (5.7 percent). From now on, Japan and the United States may become the center, and the introduction of technology from the developed Western countries will increase with the emphasis on introducing industrial technology from Japan and military and aircraft-related technology from the United States.

Japan ocupies the first place in almost every aspect of technology transfer to China. In particular, Japan has accepted a great number of Chinese graduates majoring in various areas of technology. Even as analysis of the history of technology transfer to China up until now would produce the conclusion that China is in the climax of technology introduction.

Technology transfer from Japan has involved a wide range of technology in agriculture, and also other areas, such as industrial measuring-instrument technology, special natural gas valve manufacturing technology, electron microscope manufacturing technology, air compressor manufacturing technology, and industrial sewing machines. Medium-size and small enterprise technology introduction has also increased rapidly.

Looking at strategy, technology transfer requires the mutual efforts of technical personnel from both sides and that requires a better mutual understanding.

III. Strategies of Technology Introduction

The strategy of technology introduction in China is first to make choices in technology based on the overall strategy and then to introduce certain technologies according to the plan. The characteristics of Chinese strategy in the introduction of technology related to people's livelihood are to attract technology to the country and to wait for the opportunity of international technology exhibitions to bring the practical technology into China after the acquisition of all the information, after which the discussions and transactions will proceed. The key to the discussions and the conclusion of transactions is completely determined by negotiations, and there is a substantial difference compared with practices in the developed capitalist countries.

In the procedure of technology introduction, China has first chosen urgently needed suitable technology and has carried out discussions with the companies related to that technology transfer. China also attracted tangible technology into the country through international technology exhibitions. In the discussion and the conclusion of transactions, the Chinese usually adopt a triangular negotiation pattern, which means to negotiate with both the company from which the technology is expected to be transferred and some other foriegn company, that is, to open discussions among the foreign enterprises transferring that technology. The discussion item by item and category by category and the parts which can be locally manufactured are excluded from the discussion. People who attend the discussions are technical experts, experts in commercial affairs, financial experts, and legal experts, and through the coordination of these experts, they attack on many levels to increase their negotiating strength.

The experts on commercial affairs and the legal experts have carefully studied the "Charter of Activiites on Technology Transfer" of the United Nations and

they are masters of the laws of industrial ownership. In the last few years, Chinese professional teaching materials on technology introduction have increased day by day.

According to the regulation of the policy published in 1979, articles which can be manufactured in the country will not be introduced regardless of price. In the introduction of complete sets of equipment, those which can be manufactured in China must be excluded; redundancy must be avoided; and the countries or enterprises will be chosen where parts, components, and raw and processed materials can be reasonably supplied. The stipulation mentioned above is a technology introduction policy based on technology transfer, and that technology transfer will in the long run be beneficial to the vigorous development of the country.

Technology introduction, in addition to patents, also includes the introduction of new mechanical equipment and foreign companies can proceed in the manner of investment. Therefore, these points can also be taken into consideration.

IV. Sino-Japanese Technological Cooperation

China, before the implementation of the open-door policy, received little economic and technolog cooperation from the West. The acceptance of cooperation without compensation began in 1981. Cooperation with compensation for the sake of realizing the open-door policy cannot be expanded without considering the ability to pay. The value of technological cooperation reached its climax in 1981; since then the change has been small. In general in cooperation without compensation, a big project is the Sino-Japanese hospital (completed in 1984). In addition, the construction work on the Beijing Post and Telecommunications Training Center and on the Chinese Meat Foods Multiple-research Center is continuing. The focal ponts in cooperation with compensation are items of basic construction such as railroads, harbors and dams, and telephones.

In technological cooperation, the number of graduate students and professionals sent abroad and the number of engineering projects involving technological cooperation are increasing rapidly. Of the foreign countries helped by Japan, China has been number one since 1982; however, counting in terms of the average population helped by Japan, China is still last.

The developed countries entered the Chinese market through the centers of coastal cities such as Beijing, Tianjin, Shanghai, and Guangzhou. Manchuria is the place of principal resources and an area of heavy industry in the north, though the developed countries felt that the level of technological cooperation there was not enough.

China has been emphasizing agriculture. Therefore, it has achieved very good results in the development of agriculture. In industry, China as well as other socialist countries stressed the development of heavy industry. Thus the development of light industry and medium-size and small enterprises slowed. At present, China is striving for the development of medium-size and

small enterprises and their modernization to maintain the development of heavy industry, strengthen the flexibility and adaptability of the national economy, and stimulate the vitality of the enterprises.

V. Problems of Technological Cooperation

China is a socialist nation. Therefore, both the selection of the graduate students sent abroad and their work assignments can be done according to the plan. The medium-size and small enterprises in Japan accept a great number of graduage students each year but provide mainly on-the-job-training and are not professional training organizations. The students work very hard, yet the results of their study are low. Since there are more than 20,000 Chinese graudate students sent to our country each year, we had better adopt a more systematic method to do it. And this is consistent with the direction of "education cooperation" flourishing in Japan.

China is walking along the road of socialism, and maintaining independence, and keeping the initiative in its own hands, which contrasts sharply to the capitalist market of free competition. Though it uses the same techniques, the function and meaning are different. Nevertheless, even the technology from capitalist societies can contribute to the development of socialism. The developed countries in the West and East have blocked technology transfers to the Eastern countries in the name of "Coordinating Committee for Export to Communist Areas." This has been relaxed to a great extent to China in the past few years, yet it has not been abolished and may become strict again.

Chinese patent law was implemented in April 1985. To introduce advanced technology, patent rights must be acknowledged and the technology rightly protected. Proper implementation and observation of the law have a direct influence on the international prestige of a country. As for the suppliers of technology, if the technology is not protected under the law, they will no longer transfer their technology. Whether the Chinese are able to enforce the patent law correctly to provide sufficient protection to the rights of the technology suppliers is one of their great tasks. We can also say that the above understanding will apply the same to the foreign investment law, corporate law, and commercial trade law under formulation now.

In the following article, we will talk about the relation between the "four modernizations" advocated by the Chinese and Sino-Japanese technological cooperation. Military and national defense modernization is included in the four modernizations. For some reasons, Japanese technology cannot cooperate in every aspect of the four modernizations.

Finally, I think that all the developed countries, including Japan, seem to compete for cooperation in the technology transfers to China, yet it is not clear at present whether the introduction of technology into China is for the development of Chinese socialism, which is introverted, or for the joining international (export) competition, which is extroverted. Even if Chinese technology introduction is extroverted, it may not for the developed countries end up in eating one's own bitter fruit (Chinse version [Japanese to Chinese translator's note: that is, the possibility of China's becoming a developed

country and competitor), owing to the huge gap in the levels of technology between China and the developed countries, but to the NIC's in Asia and the countries of Southeast Asia, China is very likely to become a competitor. For industrial products of equal quality, especially the production of labor-intensive products, once export becomes possible, their impact on the large countries will be enormous. In case the coordination of shared production ([Japanese to Chinese] translator's note: that is, different countries produce different products) cannot proceed smoothly, it is very likely that trade conflicts will occur between China and the Asian NIC's and the countries in Southeast Asia. If the current Chinese open-door policy continues as it has, in the 1990's Chinese exports of industrial products will increase rapidly.

To solve the above problems and then maintain and accelerate the development in Asia to contribute to the peace of the world, it is necessary to establish, through Chinese economic development and her joining the shared production structure, a healthy interdependent relationship at least in Asia. And Japanese technology transfers must proceed in line with the contribution to that relationship.

12909/13104
CSO: 4008/2086

NATIONAL DEVELOPMENTS

PRC EARMARKS MORE FUNDS TO FIGHT POLLUTION

OW280933 Beijing XINHUA in English 0735 GMT 28 Apr 86

[Text] Shanghai, 28 Apr (XINHUA)--China will spend two-and-a-half times as much on fighting pollution over the next 5 years as it did in the 1981-1985 period, an environment official said today.

The country will earmark an average of five billion yuan a year for environmental protection during the Seventh Five-Year Plan (1986-1990), said the official, who is organizing a current international fair in Shanghai on anti-pollution equipment and technology.

The fair, which is being sponsored by the Shanghai branch of the China Environmental Protection Industry Association and six other organizations, is being attended by 10 foreign firms and 200 Chinese manufacturers, colleges, and research institutes.

The official told XINHUA: "China now has 1,100 environmental protection and monitoring stations above county level, which employ 32,000 people."

More than 1,200 factories across the country were now making 1 billion yuan worth of anti-pollution equipment a year, he said.

Forty colleges have opened environmental protection courses, and 106 research institutes were specializing in environmental protection.

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CSO: 4010/54

NATIONAL DEVELOPMENTS

METALLURGICAL INDUSTRY FOCUSES ON POLLUTION CONTROL

OW180800 Beijing XINHUA in English 0732 GMT 18 May 86

[Text] Zhengzhou, 18 May (XINHUA)--The metallurgical industry ministry will double its investment in anti-pollution measures to 1.7 billion yuan in the 1986-90 period, on the basis of its success over the past 5 years.

Drawing experience from industrially developed countries, the ministry has set up a research institute of environmental protection, installed waste-treatment facilities and formed an environmental protection system involving more than 20,000 people since 1978. It has also engaged in an extensive tree-planting drive.

As a result, the rate of harmless discharged waste reached 58 percent in 1985, up from 28 percent in 1982. The ministry recorded an extra output value of 1 billion yuan in the 1981-85 period by making a comprehensive use of the waste gas, water and industrial residue.

Swarms of fish have returned to the Lianhua River near the Capital Iron and Steel Company, once notorious as a source of pollution.

The metallurgical industry saves 800 million cubic meters of water a year by recycling waste water, and uses large amounts of slag to produce cement and fertilizer.

By the end of 1985, the nation's 36 major metallurgical enterprises had planted 13 million trees and laid 1 million square meters of lawn.

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CSO: 4010/54

NATIONAL DEVELOPMENTS

REGULATIONS GIVE GREATER AUTONOMY TO RESEARCH UNITS

OW091221 Beijing XINHUA Domestic Service in Chinese 0658 GMT 8 May 86

[Text] Beijing, 8 May (XINHUA)--The State Council recently promulgated the "Provincial Regulations on Expanding Decision-making Powers of Scientific and Technological Research Organizations."

In order to add vitality to scientific and technological research organizations and to enable them to become self-governing, scientific-technological research and development entities, the State Council's document specifies that: With the guarantee of accomplishing the tasks assigned by the state as a precondition, research units are authorized, based on their respective capability and specialty, to undertake scientific and technological projects in various sectors of society, according to the needs of social, economic, scientific, and technological development. They are also authorized, based on the principle of self-determination and mutual benefit, to establish various forms of cooperative relations with enterprises, design units, and institutes of higher learning, or to set up joint ventures with them. Departments at a higher level should encourage and support them, instead of imposing restrictions. Research units may also earn legal profits by entering into contracts with other units regarding technological development and transfer, and using technologies to serve society.

The document specifies that administration and management of a research organization are the responsibility of the director of that organization. The director of a research organization is responsible for overseeing the organization's research and administrative work, and the deputy director should assist the director in his work. The director of a research organization is to be appointed and removed by a department at a higher level, and the deputy director is to be nominated by the director and his name submitted to higher authorities for appointment or removal. Both the director and deputy director of a research unit are to be appointed for a specified term of office, and they may be reappointed on completion of their term. The director of a research organization is authorized to appoint or remove middle-level administrative cadres in his organization. Retention or appointment of specialized technical personnel should be carried out in accordance with relevant state regulations. Research organizations should take measures to

NATIONAL DEVELOPMENTS

RESEARCH INSTITUTES URGED TO SUPPORT MAJOR ENTERPRISES

OW101647 Beijing XINHUA in English 1428 GMT 10 May 86

[Text] Beijing, 10 May (XINHUA)--The GUANGMING DAILY today urged major research institutes to work with China's largest state-run enterprises to boost the country's production and scientific research.

In a commentary, the cultural paper praised the work of institutes with smaller production units but said the link between major institutes and enterprises was only "at the initial stage."

Products and equipment of many of the larger enterprises are out-of-date, and it is difficult for them to improve their technology without outside help, the paper said.

China's major institutes could offer that help, said the paper. The institutes have the knowledge, equipment and the technical staff, and in the past they too often engaged in research "separated from production and on subjects not always closely linked to the country's needs."

As an example of institute-enterprise cooperation, the paper praised the joint effort of the Shanghai Institute of Silicate Research, an affiliate of the Chinese Academy of Sciences, and the Shanghai general petrochemical plant.

With the institute's help, in just 5 months the plant was able to upgrade its 7,000 meters of heating pipes, saving 7,000 tons of crude oil worth more than 400,000 yuan a year.

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CSO: 4010/55

improve management and promote the democratic management system. They may set up a committee to handle the general affairs of their organization, as well as an academic or technical affairs committee; and may organize a staff and workers' congress, or set up other democratic management organizations. They should fully respect, and give play to, the role of technical workers and other staff and workers in examining the organization's major decisions; in overseeing leaders at various levels, including the director of the organization, and in safeguarding the legal rights and interests of the workers.

Regarding personnel management at research organizations, the document specifies that: All research organizations receiving funds from the state are authorized, within the organizational size authorized by the state, to make their own decisions on recruitment, dismissals, and arranging jobs for personnel of all divisions on the basis of a reasonable personnel structure and according to the relevant state regulations. Research organizations fully operating on their own funds may make their own decisions on retaining personnel required to carry out their organizations' work, provided that the personnel management system of the state is observed. For those personnel assigned to a research organization, the organization should put them under probation and evaluate their performance. It is authorized to refuse to accept those personnel whom it considers unsuitable for its work, or send them back to their original units while they are still under probation. Research organizations should expand the authority of their project managers. Project managers should be given the power to arrange their personnel according to the needs of their work.

The document specifies that: Research organizations are allowed to make their own decisions on how to use funds gained through different channels according to relevant state regulations. Research organizations' income from technical sources is temporarily exempt from income tax. New products and intermediate-test products of research organizations will be exempt from tax, or taxed at reduced rates, according to established regulations.

Research organizations fully operating on their funds should set up a fixed asset depreciation system as enterprises do. They are also authorized, according to relevant state regulations to dispose surplus equipment and materials other than large and precision instruments and equipment invested by the state. Research organizations, in the process of financially supporting themselves, should try to set up a similar system as their financial self-sufficiency permits. Research organizations should make every effort to increase the rate of utilization of large and precision instruments and equipment. They should also provide service to the public or enter the leasing business. A large portion of income from these sources should be used to modernize the organization's fixed assets. The state will selectively provide support for construction of research bases, and large and precision instruments and equipment for research organizations.

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CSO: 4008/64

NATIONAL DEVELOPMENTS

NECESSARY CONDITIONS FOR JOINT VENTURES

Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENTIOLOGY AND MANAGEMENT OF S&T] in Chinese No 2, 1986 pp 6-7

[Article by Keizo Umeda, Himeji Junior College, Hyogo Prefecture, Japan; rewritten by Yong Qian [0516 3677], Zhao Beiwang [6392 054 2598], chief editor: "Necessary Conditions for Joint Ventures"]

[Text] In a world where science and technology progress day by day, it is rather difficult to be outstanding among other competitors; therefore, every enterprise tries to change the structure of its industry and technology and consolidate its position through joint ventures.

However, there are also lots of examples of termination of an agreement of cooperation among the developed countries. At present, the conflicts are acute. In general, joint ventures have the following problems:

1. The items of joint-venture enterprise are more mature, so the introducing country loses the characteristics of being a new producer and also loses the true significance of joint ventures. Thus a joint-venture enterprise can be banned easily by the mother company.

2. Owing to the recession of joint-venture enterprises, their strategies of management must change; otherwise the result will be that the investor country cuts its investment and limits it to a small amount of capital or recalls its total investment. Consequently, the other party revokes the administrative power of the investor.

3. The elimination of obstacles to both parties on the basis of mutual understanding and mutual trust between the two partners not only in appearance and formality but also in an honest and sincere exchange of opinions and management.

4. In case difficulties or problems in management emerge in the mother company, the contract is cancelled and the enterprise is managed independently by a single party.

Therefore, it is necessary to summarize conscientiously the causes of failure of joint-venture enterprises and pursue the ways and means of success and improvement.

Sources from multinational enterprises in Europe and Japanese enterprises abroad reveal that the causes of failure of joint-venture enterprises can be summed up as follows: incomplete market research and inadequate investigation within the enterprise, poor management by the mother company, and a change in foreign investment from the mother company.

The causes of failure from the local society include inconsistency of opinions with the [mother?] company and external causes, mainly from an economy that is overproducing. To avoid the above-mentioned occurrences, the key is to maintain harmony with the local enterprises and collect information from the client countries to become mutually prepared; select the places for local investment, analyze the characteristics of the products and the competitive situation, predict the buying power of the joint-venture enterprise, and determine the purchasing price, conditions, and commercial customs, according to the size of the market; and analyze, through the cycle and according to the cost of transportation, the conditions for production equipment, materials, regulations about the social effects of pollution, and labor in order to explore the productivity of the enterprise, the tax system, capital transfers, and the budget. The most important among the conditions mentioned above is how to make a selection. It affects whether the enterprise can be successful or not. Besides, it is necessary to study further the culture and history of the host country in order to communicate for the joint-venture enterprise and eliminate misunderstandings. Also attention must be paid to the distribution of authority. It is necessary to conduct technology transfers and develop new technology on a broad scope from manufacturing and processing to management.

In technology transfers, it is important to introduce new technology; however, it is even more important to develop new technology. If new technology is developed, there will be room in both the developed and the developing countries for technology transfers. Modern multinational enterprises do not rely on capital or ownership but pay attention to the distribution of production in order to enhance the cooperation between East and West.

Nevertheless, the essence of joint-venture enterprises is to enable the partners to draw on the strengths of each to offset the weaknesses of the other to maintain the cooperative system. Once mutual trust is established among the partners, it is necessary to overcome any difficulties; otherwise, that organization is bound to collapse, no matter what it is. This is what we should always remember.

But in the past few years, the international investment environment has changed and some new problems need to be solved urgently. As we saw in Iran, even in a so-called stable market and host country, with revolution, internal disorder, and war and with the ending danger of a termination of the projects in progress and a takeover of capital before fulfillment of the contract, the future situation can be hard to imagine. Countries with an accumulated debt include most developing countries striving to carry out their economic

policies but these countries are still thought to be the most promising countries as host countries for investment. However, because of the accumulated debts, the profit received by the host country is greatly limited and, as a result, the reinvestment of that profit in the host country by the investor is limited.

Thus, there are strategic measures such as the signing of an investment protection agreement between the investor and host countries in order to lessen or minimize the investment danger.

In China there are in general many achievements in the acceptance of foreign investment, but the following problems still exist: 1) there is more cooperation based on an agreement but few on joint venture; 2) more capital comes from Hong Kong and Macao compatriots and little comes from foreign enterprises, or consortiums; 3) there are more medium-size and small items but few large ones; 4) there is more investments in tertiary industries but little in manufacture for export; 5) in intended investments which have been revealed, there are more items which require longer terms of negotiation while few eventually arrive at a satisfactory conclusion; 6) the amount of investment stipulated in the contract is high while the actual investment is low; 7) more foreign investment is introducted but foriegn exchange created with the foreign investment is little.

In joint-venture enterprises with investment from Japan, from basic enterprises to enterprises representing a great volume of trade, and if underwater operations are included, along with the increase in the number of joint-venture enterprises, the kinds of the enterprises have also expanded in many aspects, from the servicing and manufacture of motors or generators and fiber products to the manufacture of automobiles.

The reasons for the rapid growth in Sino-Japanese joint ventures are, first, because China has made great efforts to expand favorable treatment and enhance the law. However, the problems caused by the increase of joint-venture enterprises have become cleared. The main problems are the following: now, in the joint venture, the most troublesome thing for the Japanese party is the pricing of land and the second is the insufficiency of transportation at the harbors, which affects exports. Therefore, the harbors need to be reorganized and enhanced and new ones built. Third, people do not quite trust the supply of energy and raw materials. Though the supply of energy and raw materials for joint-venture enterprises has priority, severe energy shortages in the country exist, especially in electricity, and when joint-venture enterprises increase later on, the stable supply of electricity in some places may experience some difficulties. Fourth, the sovereignty of labor enterprises, yet the enterprises can only recruit workers in the suburbs; they hope to recruit the finest workers in an wider area but there exist difficulties in applications for residence in the municipalities. Furthermore, wages tend to rise, especially when there is a shortage of people who can speak foreign languages, and their wage increases have been great. Besides, there are some problems in labor control. In the establishment of some joint enterprises, some managers think they must fully realize the meaning of the existence of the labor union. The fifth problem relates to the regulations about the

distribution of foreign exchange and the strengthening of the obligations to export. Owing to the strict control policy over foreign exchange, joint-ventures enterprises or those based on technological cooperation with foreign countreis worry about their production being caught up in difficulties, and so foreign exchange capital must be positively suppled for the importation of advanced foreign technology by local export industries. If foreign exchange capital becomes more flexible and accommodating, the foreign exchange control will be relaxed a little, and thus the obligation to export for the joint enterprises will be strengthened. Sixth, along with the progress of technology transfer, some disputes over the expense of technology transfer will arise. In the introduction of foreign advanced technology, some Chinese in charge do not know about paying technology consulting fees, fees for using others' patents, and deposits for security. For example, the unwillingness to acknoweldge the value of some technologies is the biggest stumbling block in the trade for foreign enterprises to transfer technology to China. In the future, in the cooperation between China and foreign countries, if China does not acknowledge "technology fees," the work of introducing advanced technology will not be able to proceed smoothly. The seventh problem is the restriction of investment proportions in joint enterprises. China has strict restrictions on the number of enterprises that have foreign capital in the majority, which is contradictory to the regulations of joint-venture enterprises. The final important thing is the terms of the joint enterprise. The Japanese enterprises hope that the term designated by the current regulations will be extended appropriately.

12909/13104
CSO: 4008/2086

NATIONAL DEVELOPMENTS

RECORD NUMBER OF AWARDS FOR SCIENTISTS, INVENTORS

OW081352 Beijing XINHUA in English 1232 GMT 8 May 86

[Text] Beijing, 8 May (XINHUA)--China announced here today that 1,761 scientific research achievements, including the "Changzheng No 3" carrier rocket, have won national awards for promoting scientific and technological advances.

Premier Zhao Ziyang and other state leaders will soon award prizes to more than 3,800 scientists and inventors who have made great contributions to their country, at a national meeting for scientific and technological rewards to be held here next week.

This is the largest number of awards for scientific and technological research since the founding of the People's Republic of China in 1949.

"It is unprecedented in China's history to reward so many scientists, inventors and technicians," a spokesman for the state science and technology awards office said.

He explained that the purpose is to encourage scientists and technicians and bring into full play their initiative and creativity in order to accelerate the nationwide modernization program.

The 1,761 winners were chosen from 20,000 scientific research achievements by a 57-member committee over the past seven months.

They cover a wide range, including national defense, machinery, electronics, chemistry, metallurgy, light and textile industry, agriculture, forestry, medicine, power, transport, and other sectors.

These scientific research achievements have yielded remarkable social benefits and economic returns--estimated at 110.8 billion yuan in total.

The facts show that they have played an important role in developing the national economy, national defense and other sectors. They will play greater role in accomplishing the Seventh 5-Year Plan (1986-1990) and help narrow the gap with the advanced nations of the world.

According to the committee, the special-class awards were given to 23 achievements, including the "Changzheng No 3" carrier rocket, a water-injection technique to help Daqing, China's largest oilfield, sustain a stable and high output, and a technique for producing maleic rubber.

The first-class awards were given to 135 achievements, while 535 achievements won the second-class awards, and 1,068 achievements the third class.

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CSO: 4010/55

NEW REGULATIONS SEEN AS CATALYST FOR SCIENTIFIC REFORM

HK170712 Beijing CHINA DAILY in English 17 May 86 p 4

[Editorial by CHINA DAILY Commentator: "Science Reform"]

[Text] Science reform has taken another big step forward with the recent promulgation of the new regulations on enlarging the decision-making power of scientific research institutes throughout the country.

The regulations list only two requirements for these institutes. First, they must be committed to fulfilling the tasks assigned them by the state. Second, their chief executives, who will now shoulder more responsibility, are appointed and removed by higher authorities. When these two prerequisites are met, they are free to do whatever they think fit so long as their activities come within the bounds of the laws and decrees of the state.

The director of a research institute is in complete charge of all work, professional and administrative. And the institute has the power to hire and discharge according to requirements--a guarantee that all personnel doing research are completely qualified and competent. Overstaffing, as is the case with some institutes, will be prevented or remedied.

With regard to funds obtained through different channels, institutes have the power to spend them at their own discretion without outside interference. For instance, they can set up foundations for development, welfare and bonus purposes. And they can dispose of their surplus facilities and materials in compliance with state regulations. With the approval of government offices at ministerial and provincial levels, a research institute can directly conduct cooperative and exchange activities with foreign counterparts.

Most important is that, according to the new regulations, an institute is vested with the power to undertake from any quarter all kinds of scientific and technological tasks based on the needs of social, economic and scientific development, as long as it has the prerequisites. It can, on the principle

of free will and mutual benefit, forge cooperative ties in various forms with enterprises, designing units and colleges. And it can enter into contracts with other units in terms of technical development, transfer and application, all in the interest of society, and obtain income through these channels. Thus, the achievements of research, now marketable commodities, are made more easily available to those who need and intend to buy them.

Pilot experiments have revealed that great advantages can be had from such practices as are now embodied in the new regulations. Some of the most important ones are: the working initiative of the staff can be actuated; the successful results of scientific research can be more readily popularized in production processes; science and technology can be better geared to the requirements of the national economy to boost the modernization drive; and, finally, the institute can more effectively tap its own potential and streamline management.

Reform in the management system of science and technology aims primarily at furthering integration of the two with the development of the nation's economy so that both can better serve China's modernization programme.

/8309
CSO: 4010/55

NATIONAL DEVELOPMENTS

BRIEFS

NATIONAL S&T ACHIEVEMENTS--Beijing, 2 May (XINHUA)--Thanks to the hard work of more than 100,000 scientists and technicians, 38 key state scientific-technological projects have been completed according to schedule under the Sixth Five-Year Plan. By the end of "February 1986, a total of 3,896 important scientific and technical results had been achieved. [quotation as printed] The application of more than 3,200 of them in production has resulted in a significant rise in economic results. The 38 key research projects covered agriculture, energy, transportation, mechanical electronics, raw and semifinished materials, the consumer goods industry, and new technological and social development. The development of more than 327 new seed strains has increased China's annual grain output by about 20 million jin. China's output of polyester short fibers has been boosted by the manufacture of whole sets of equipment. [Summary] [Beijing XINHUA Domestic Service in Chinese 1347 GMT 2 May 86 OW] /8309

CSO: 4008/64

APPLIED SCIENCES

REVIEW OF AERODYNAMIC CHARACTERISTICS OF REENTRY VEHICLES

Mianyang KONGQIDONGLIXUE XUEBAO [ACTA AERODYNAMICA SINICA] in Chinese Vol 4, No 1, Mar 86 pp 88-98

[Article by Huang Zhicheng [7806 1807 3397], China Aerodynamic Research and Development Center: "A Review of Aerodynamic Characteristics for Several Recovery Schemes of Reentry Vehicles"]

[Text] English Abstract: This paper presents a review of aerodynamic characteristics for several recovery schemes of reentry vehicles. These schemes include the aft jettison mass plus parachutes, the sidewise jettison mass-drag cones plus parachutes, towed cones plus parachutes, the drag brakes plus parachutes, the aft jettison mass-drag plus parachutes. The features of pattern of air flow for these schemes, the results of test in wind tunnels and the results of engineering calculation methods are emphasized, then a ballistic analysis and comparison of performance for these schemes are carried out, and the suggestions about the selection of schemes and further work are put forward.

In recent years, recovery of reentry vehicles has been an important technical watershed in developing high level reentry vehicles. In the early period, the aim of recovery was to determine the survival of the warhead reentry into the environment and the safety of the heat resistant design, and evaluate the heat resistant layer of the duantou [4551 7333] and surface and the heat resistant design of the antenna window; in recent years, interest has shifted to factors of erosion of the contour and influence on the tumble moment of force and nonuniform erosion. Low level erosion of the contour in recovery can provide a basis for researching the influence of erosion on aerodynamics; comprehensive assessment of theoretical calculations on erosion of the contour and the performance of duantou indentation rate test devices can also be carried out. To achieve the above recovery aim, it is necessary to reduce the value of the ballistic coefficient after the appearance of the maximum aerodynamic heat environment to 1/2 to 1/3 its original value, and at this time, the contour of the recovery duantou will be close to the landing contour of the actual flight vehicle.[1]

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Jettisoning mass and increasing drag are two basic techniques in recovery technology which can be used independently or combined to achieve the recovery aim. In addition to increasing the drag coefficient, the surface area of the bottom can be increased to increase drag, and since in jettisoning mass the surface area of the bottom is changed. This point should be noted when comparing the deceleration performance of these schemes. Summarizing references from abroad, the following schemes have been studied for reentry vehicles with high ballistic coefficient: (1) aft jettison mass plus parachutes[2]; (2) sidewise jettison mass-drag cones plus parachutes[3,4]; (3) towed device plus parachutes[5,7]; (4) drag brakes plus parachutes[1,7,8]; (5) aft jettison mass-drag brakes plus parachutes[1]; (6) angle of attack control scheme[9,10]. The last scheme is still in the exploratory stages because the lateral overload is very large[14]. This paper deals primarily with the first five schemes. The aerodynamic problems of scheme (1) are primarily problems of aft jettison mass aerodynamcis, scheme (5) is a combination of schemes (1) and (4), thus aerodynamically we will discuss primarily schemes (2), (3), and (4). In addition to the rather mature parachute dynamic characteristics and the dynamic problems, problems in two areas in the aerodynamic problems of these schemes must be solved: 1. the aerodynamics, aerodynamic heat, and the dynamics problems of the recovery body. When comparing schemes, we primarily discuss the drag characteristics of the schemes, paying appropriate attention to the scheme's static stability (generally speaking, adopting increased drag measures will increase static stability) and the aerodynamic heat environment. 2. Aerodynamic problems in the jettison mass process. The aerodynamic problem of aft jettison mass is very close to the drag cone jettison process. For sidewise jettison mass, the problems of the shell and the aerodynamic interference of the recovery body itself must be resolved to avoid collision between the two bodies and excessive disturbance caused by the recovery body[11].

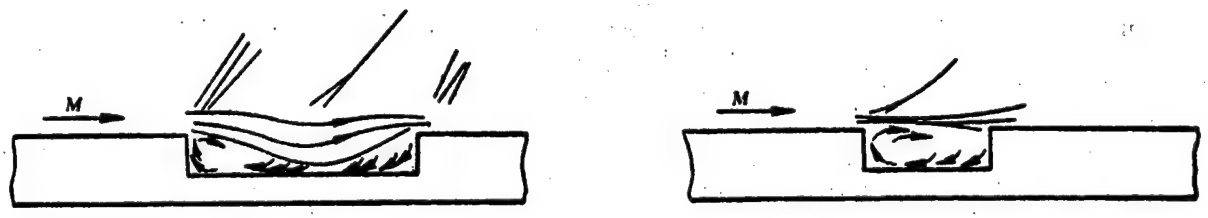
II. Discussion of Recovery Body Separation Flow

Although the flow of the recovery body has its own characteristics for the sidewise jettison-drag cone, towed cone and brake schemes, there are also some common laws, i.e., there are two types of separation flow, open and closed. Reference [12] pointed out this flow phenomenon when researching supersonic flow around cavities (Fig. 1). For flow between the fore and after body, reference [12] pointed out that for the distance between the fore and after body there is a critical value, and if this value is exceeded, a closed wake appears and if it is smaller than this value, it is an open wake (Fig. 2); it also pointed out that when the ratio of the diameter of the fore and after body comes near to 1, this critical value is a distance two- or three-fold the diameter of the forebody starting with the bottom of the forebody. In the specific scheme, the flow around the recovery body should be much more complex than the above analysis. For the sidewise jettison-drag cone, although the bottom of the front cone may form a closed wake flow, attached flow or separation flow may appear at the front of the skirt. For separation flow depending on different M numbers, Re numbers and skirt shape, can be attached or not attached to the skirt, that is it can form closed or open separation flow (Fig. 3). Qualitatively, if the skirt

angle is too large (e.g., larger than 30°) or if the background stage angle is too great and the Re number is reduced, separation flow can easily form. For the towed cone scheme, an independent towed cone placed in uniform lailiu [0171 3177] also exhibits attached body flow and open separation flow (Fig. 4), but under general situations, an open separation flow even more readily forms in the forebody wake. If there is no rod or cable connection between the fore and after body (relative to the aft jettison mass), generally there is a tuoti [5192 7555] shock wave in front of the towed cone, and at this time the towed cone's drag is greater (Fig. 2b). If there is a rod or cable link in the middle, then the flow diagram is similar to the sidewise-drag cone flow, and at this time the open separation flow that forms diminishes the drag. The drag brake scheme can be seen as a skirt with fengxi [4911 7138], which easily forms an attached body flow or closed separation flow. However, for small purity ratios and medium drag plate angle of deflection, open separation flow was also observed in the wind tunnel tests (Fig. 5). Wind tunnel tests demonstrated that if open separation flow appears on the recovery body, the drag is clearly reduced, thus the appearance of this type of flow should be avoided in design as much as possible.

III. Aerodynamic Characteristics of the Sidewise Jettison Mass-Drag Cone Scheme

When M_∞ = 3.01, 4.02, 5.05, wind tunnel tests show that in terms of aerodynamics, the drag skirt scheme is superior to the scheme of making a drag cone in the middle of the column by creating a cavity, the drag cone scheme can easily produce open separation flow but the drag skirt scheme only requires a skirt angle of less than 30° to avoid open separation flow; yet with a similar after cone angle the drag of the drag skirt should be much higher than that of the drag cone; the drag of the drag skirt is much smaller with erosion of the contour and changes in the purity ratio; the pressure center of the drag skirt tends to be behind the drag cone. Since structural factors can actually only make slight cavity drag cones, their aerodynamic properties should be closer to drag skirts. The following results were obtained through experiments with transultrasonic wind tunnel, hypersonic wind tunnel[14], pao [3517] wind tunnel[15], shock wave wind tunnel[15,16], and free flight ballistics[17]:



a. Closed-type cavity flow L/M>14

b. Open-type cavity flow L/H<10

Fig. 1. Cavity Flow

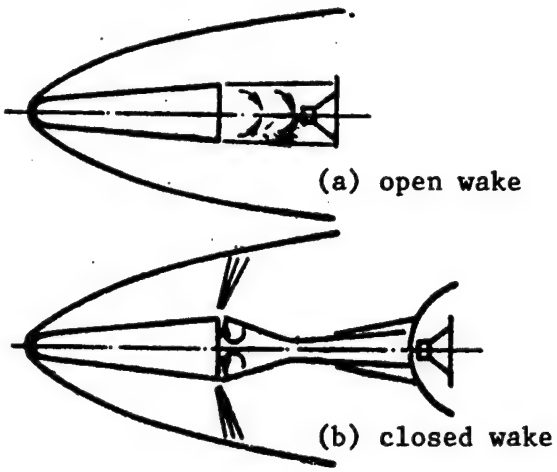


Fig. 2. Towed Cone Flow

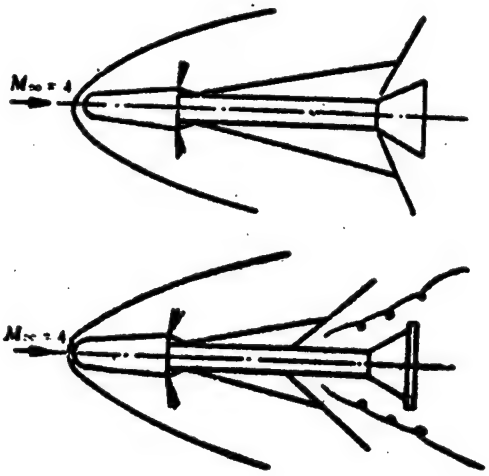


Fig. 3. Flow Diagram of Sidewise Jettison-Drag Cone in Hypersonic Wind Tunnel

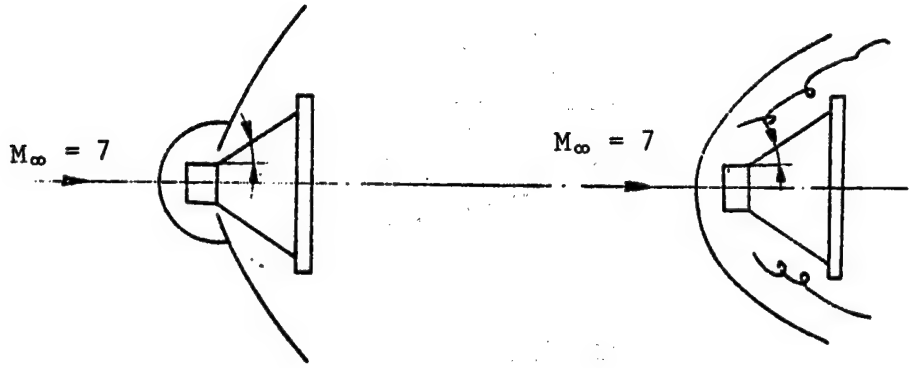


Fig. 4. Flow Diagram of Single Towed Cone in Hypersonic Wind Tunnel

1. The drag cone contour has a clear impact on drag. In the hypersonic wind tunnel, the drag of the contours of after cone angles of 25° and 40° was smaller than the drag of the contour of after cone angles of 30°, if the drag cone has back step it lowers the drag. When M_∞ = 4.04, the after cone angle is 30°, after eliminating the step, the drag coefficient increases from 0.26 to approximately 0.60; but then if the after cone angle is 40°, after eliminating the step, the drag coefficient only increases from 0.25 to 0.29. When the after cone angle is 30°, the drag cone becomes four post stretched wings and the drag coefficient reaches 0.54.

2. Purity ratio and changes of the erosion contour have a definite influence on drag. Results of pao wind tunnel and shock wind tunnel tests (Fig. 6) show that increasing the purity ratio makes the drag coefficient drop. In the pao wind tunnel we also tested the influence of erosion contour (including cavity contour, and 55° dual cone contour and flattop contour), and the several contours made the drag coefficient drop. The maximum drop was caused by the dual cone contour which made it drop 9 percent.

3. The test results of free flight ballistic and different wind tunnels testing for the range of M_∞ numbers can be linked (Fig. 7). Figure 7 sets out the results of engineering calculations. Neifuniudun [0355 0126 3662 7319] theory[18] was adopted for calculating the pressure distribution of the fore-cone and aftercone. The boundary layer outer edge parameter made the entropy layer swallowing processing, using the common heat flow calculation formula through the Reynolds analogy from heat flow negative thrust friction, for bottom pressure the commonly used experimental formulas in the documents were used. The results of the calculations demonstrated that for situations in which open separation does not occur, the calculations and the test results of the various types of devices were roughly the same. The results of the hypersonic wind tunnel M_∞ = 9 and P_0 = 29 atmospheres were inclined to be low (C_D = 0.0.305), but the value of C_D became higher in P_0 = 68 atmospheres (C_D = 0.329, represented in the figure by black dots), and at this time the flow field photographs prove that it is attached body flow. The results of M_∞ = 9, P_0 = 60 atmospheres in this wind tunnel tended to be much lower (C_D = 0.145) and from the flow field photographs it could be determined that

at this time an open separation flow appeared. Figure 8 gives the axial force coefficient with changes in the angle of attack. When $M_\infty = 9$, the axial force coefficient increases very rapidly with α, this means that when the angle of attack increases, the skirt's windward side forms an attached body shock wave, and when $M_\infty = 5$ and the angle of attack is zero, an attached body shock wave appears on the skirt front, therefore the axial force coefficient changes rather gently as the angle of attack changes. In free flight tests in the shock wave wind tunnel, when $M_\infty = 8.9$, the drag coefficient also was about 0.18, and at this time $Re = 1.3 \times 10^6/m$. In trans-ultrasonic wind tunnel tests, when $M_\infty = 1.15$, the drag coefficient tended to be much lower and from flow field photographs it could be determined that an open separation flow appeared. It should be noted that there were slight differences in the dimensions model of the free flight ballistic initial test and the model of the hypersonic wind tunnel test, and later tests on similar models were carried out and the drag coefficient found was slightly low (indicated by black dots in the figure). The free flight ballistic shadowgraphs prove that an attached body shock wave appeared on the skirt.

4. In all the tests, no matter what the changes in the contour, within the range of changes in broad M numbers and in the angle of attack, the ratio of pressure center position and model length was greater than 0.8, thus arranging the center of gravity appropriately, a greater static stability plentitude could be obtained.

5. The free flight ballistic test results show that $C_{m_q} + C_{m_a}$ is a positive value, between 1 and 3, and the results of the calculations using Neifuniudun theory[13] show that when the angle of attack is less than 4°, $C_{m_q} = C_{m_a}$ is a positive value, thus with a small angle of attack, a negative damping situation can appear.

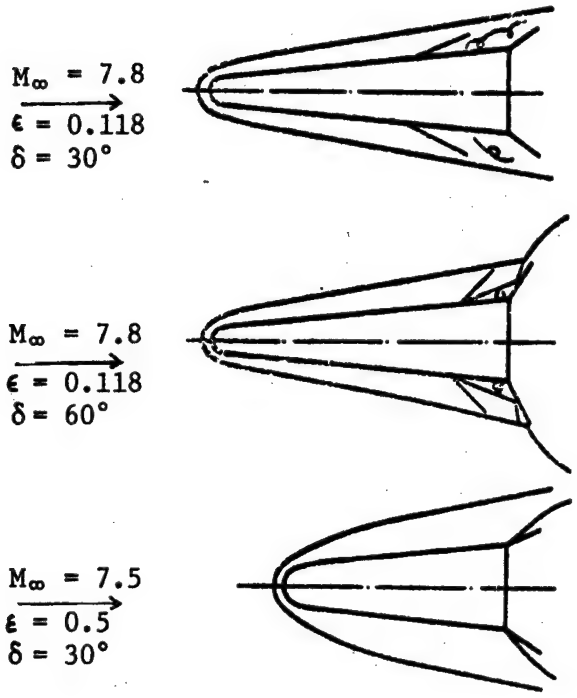
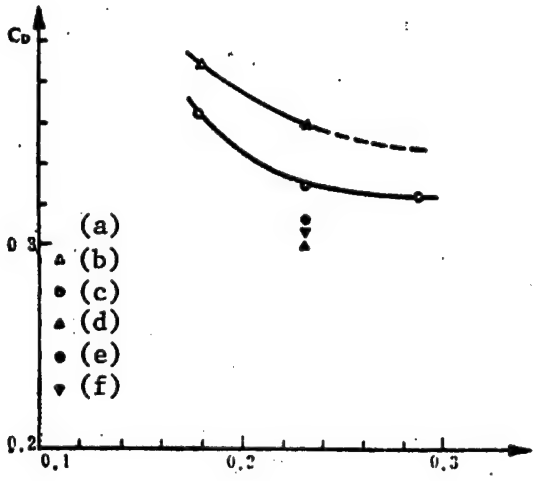


Fig. 5. Flow Diagram of Drag Brake Scheme in Pao Wind Tunnel



Key:

a.	Head shape	M_∞	Re^1/m
b.	Spherical	6.5	$1x10^7$
c.	Spherical	7.8	$3.5x10^7$
d.	Twin cone	7.8	$3.5x10^7$
e.	Cavity	7.8	$3.5x10^7$
f.	Flattop	7.8	$3.5x10^7$

Fig. 6. Drag Coefficient of Recovery Body Under Sidewise Jettison-Drag Cone Scheme at Zero Angle of Attack With Changes in the Purity Ratio

In addition to force measurement tests, pressure measurement tests of the recovery body were carried out in the hypersonic wind tunnel[19] and heat flow and pressure distribution measurements were carried out in the shock wave wind tunnel[20]. The test results show that the pressure and heat flow values on the cylindrical section were lower, and the changes were rather gentle. On the skirt, the results of hypersonic wind tunnel $M_\infty = 5$ when the purity ratio was sharp or small, a peak value appeared in pressure, and when the purity ratio is larger, the pressure grew nonlinearly, but in the shock wave tunnel with a higher M number, peaks appeared in both pressure and heat flow, with the heat flow peak position being slightly forward of the pressure peak position, however, the maximum heat flow value still did not exceed one-half of the arrest point heat flow value. Comparing our heat flow engineering calculations and test results, apart from the fact that the calculation values for a small section on the back of the rear step were inclined to be high, the other places were comparatively uniform (Fig. 9), and because the influence of the rear step was eliminated in the calculations, the differences in the vicinity of the rear step can be predicted.

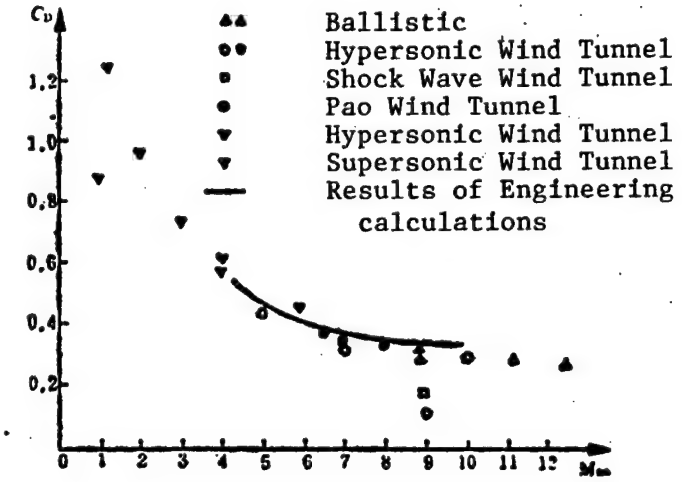


Fig. 7. Drag Coefficient of Recovery Body Under Sidewise Jettison-Drag Cone Scheme at Zero Angle of Attack With Changes in M_∞

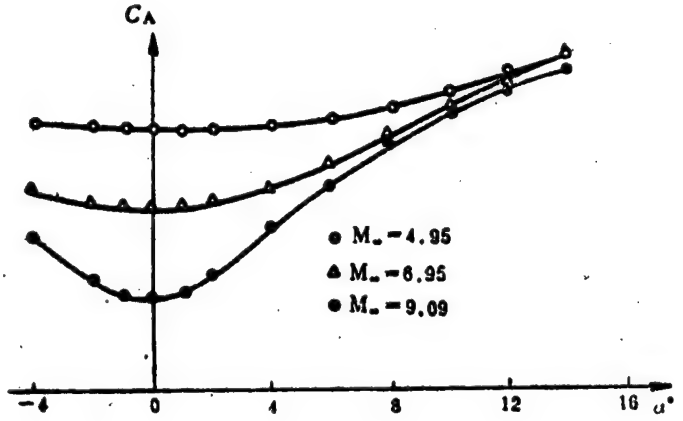


Fig. 8. Axial Force Coefficient of Recovery Body Under Sidewise Jettison-Drag Cone Scheme in Hypersonic Wind Tunnel With Changes in the Angle of Attack

IV. Aerodynamic Characteristics of the Towed Cone Scheme

The towed cone is the most typical of towed devices. The recovery body and the towed cone can be linked rigidly or flexibly. The most interesting problems of the aerodynamic characteristics of towed cones are the towed cone drag and stability. In the test results abroad[5,6], the forebody was a pointed cone, and the test M number was rather low. The results obtained in measurements in transultrasonic[19] and hypersonic wind tunnels[20,21] are below:

1. The tests verified the concept of "critical distance." The tests showed that the critical distance was less than 3-fold the diameter of the bottom of the forebody. The tests also verified that the critical distance is inclined towards the front when the towed cone is shifted more to the front than to the back.

2. The tests showed that forebody purity and end erosion contour have a clear influence on towed cone drag. The greater the purity, the smaller the towed cone's drag (Fig. 10). When the purity ratio is 0.461, the end changes to 55° dual cones, and C_D drops 10 percent. The towed cone drag coefficient drops rather quickly with the M number (Fig. 11).

3. The tests showed that the drag coefficient in a towed cone forebody wake diminishes as the M number increases. The difference of the drag coefficient in an even flow and the drag coefficient in uneven flow of a towed cone increases as the M number increases. In an even flow field, the drag coefficient of a towed cone with 40° cone angle is smaller than when it is 30°, because in the former, an open separation flow appears (Fig. 4).

4. The Re number also has a definite influence on towed cone drag. In the hypersonic wind tunnel, when $M_\infty = 4$, the forechamber pressure increased from

2.5 atmospheres to 25 atmospheres, and when the corresponding Re number increased from 0.116 x 10^8/m to 1.142 x 10^8/m, the drag coefficient increased 10 percent.

5. Rod and cable both made the towed cone drag coefficient decline compared to when there were no rod or cable and from the schlieren photographs it can be seen that separation shock waves appear on the rod and cable, thus causing the drag coefficient to drop.

6. The towed cone contour also has an influence on the drag coefficient. In the hypersonic wind tunnel, when M_∞ = 5, when the front step is eliminated, the drag coefficient increases from 0.457 to 0.50, and when the rear brake is eliminated, it drops to 0.43. When the towed cone angle is changed from 30° to 40°, the drag coefficient increases.

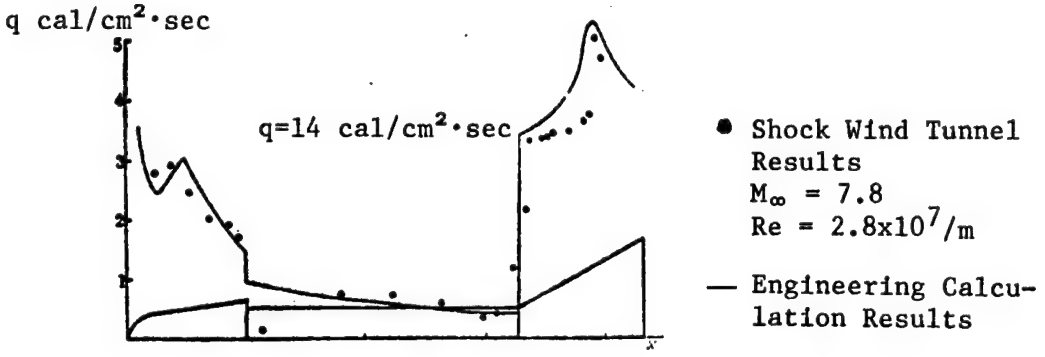


Fig. 9. Heat Flow Distribution of Recovery Body Under Sidewise Jettison-Drag Cone Scheme

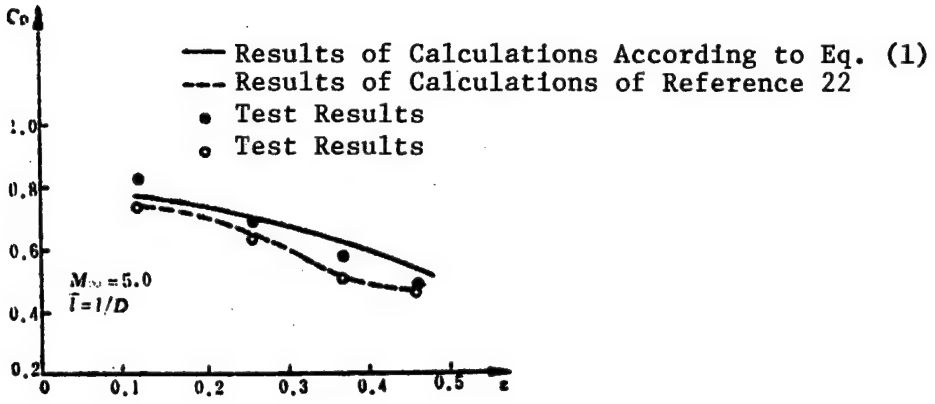


Fig. 10. Drag Coefficient of Towed Cone in Hypersonic Wind Tunnel With Changes in the Purity Ratio

Reference [22] supposes the wake neck position is 3-times the diameter of the bottom and that the neck width is 1/2 the bottom diameter, makes a straight line at the midpoint linking the shoulder and the neck width the backflow region boundary, then carries out the calculations according to the method of reference [23], the calculated dynamic pressure distribution is roughly the same as the experimental results abroad, as the distance from the bottom increases, the dynamic pressure peak increases, the peak position tends away from the axis, which is caused by the shock wave of the neck. The calculation results also show that the forebody purity ratio has a clear influence on the dynamic pressure cross-section, the pressure peak value of a large purity ratio is small and the peak value position tends further away from the axis. In addition, on the basis of reference [24] we feel that after it is larger than the critical distance, the wake velocity cross-section has similarities, combining the equations of reference [24] and [25], introducing the influence of the M number, we give the linked equations of the velocity cross-section:

$$\frac{V}{V_\infty} = 1 - A\left(\frac{X}{D}\right)^{-0.815} e^{B\left(\frac{Y}{D}\right)^2} \qquad (1)$$

$$A = 0.42\, e^{\left(0.2166 M_\infty^{\frac{1}{2}} C_D\right)} \qquad (2)$$

$$B = -7.89 e^{\left(-1.3134 C_D\right)} \qquad (3)$$

in which D is the diameter of the forebody bottom, X is the axial distance starting from the bottom of the forebody, Y is the perpendicular distance from the central axis, and C_D is the forebody drag coefficient. After finding the dynamic pressure cross-section and the velocity cross-section, according to reference [26] we can use the revised Newton equation to calculate the towed cone drag. From Figures 10 and 11 it can be seen that good results can be obtained using the two above methods.

The towed cone stability tests in a hypersonic wind tunnel[20,21] showed that at the critical distance there is an unstable area, and this is identical to the results of references [5], [6], and [27]. These references also point out that farther distances which are greater than the critical distance, when the towed cone half cone angle increases to 45° or half cone angle 40° but the towed cone drag brake diameter is greater than 15 percent of the diameter when there is no drag brake, instability occurs. Reference [35] makes a preliminary dynamic analysis of the experimental results of the hypersonic wind tunnel.

V. Aerodynamic Characteristics of the Drag Brake Scheme

Drag brakes are a commonly used means for increasing drag on flight vehicles. Wind tunnel tests show that when small wing surfaces are opened on the outer surface of a reentry vehicle, a rather large drag can be created and the number, position, shape, and size of the wings has a clear influence on drag. The scheme we researched consisted of four drag brakes extended on the bottom of the reentry vehicle, and the following results were obtained in hypersonic[28] and shock wave[29] wind tunnel tests.

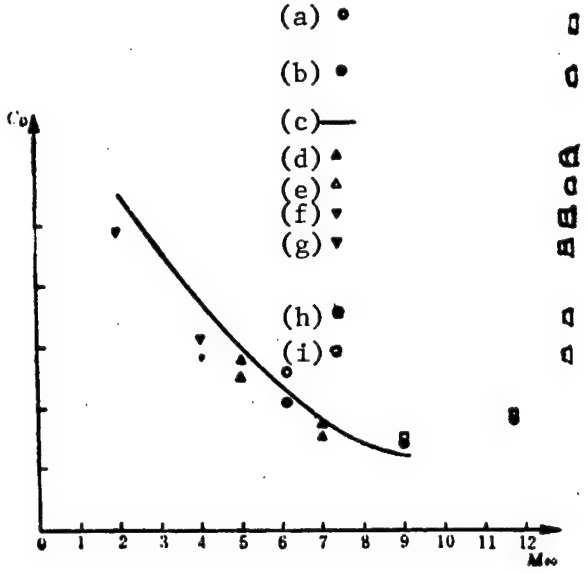
1. Although there were major differences in the condition of the hypersonic and shock wave wind tunnels, the trend of the test results was uniform. The increased drag effect of the drag brakes increased as the angle of attack, zhejiao [2124 6037 fold angle?], drag brake surface area, and bottom surface area increase, and diminish as the M number (when not larger than the angle of attack) increase. The advantage of the drag brake scheme compared to other schemes is that under high M numbers there is still a high drag coefficient and under high M numbers, changes with the M number are rather gentle.

2. The purity of the recovery body has a clear influence on overall drag. Without drag brakes, the drag of the reentry vehicle increases as the purity ratio increases, but increase in the purity ratio makes the dynamic pressure and the M number of the drag brakes drop, thus there is a critical purity ratio, and at this time the overall drag is at its smallest (Fig. 12).

3. When the angle of attack approaches 0° or is small, the increase drag effect of increasing the height of the drag brakes is better than increasing the width. At this time the increased proportion of drag exceeds the proportion of drag brake surface increase, because it expands the scope of the high pressure area on the brake. For example, if $M_\infty = 7$, the purity ratio $\epsilon = 0.259$, the zhejiao $\delta = 45°$, when the ratio of the drag brake area and the bottom area increases from 0.048 to 0.064 the zero angle of attack drag

coefficient increases from 0.3 to 0.437. However, after the angle of attack $\alpha \geq 4°$, the effect of increasing the drag brake height and the effect of increasing the zhejiao, clearly dropped.

4. Changes in the erosion contour cause the drag coefficient to clearly drop: when the top is a 55° cone, M_∞, the drag coefficient drops 7 percent.



Key:

a. Hypersonic Wind Tunnel, Contour (i=4.2)
b. Hypersonic Wind Tunnel, Contour (i=3.8)
c. Results of Calculation According to Eq. (1)
d. Hypersonic Wind Tunnel, Contour
e. Hypersonic Wind Tunnel, Contour
f. Hypersonic Wind Tunnel, Contour
g. Transultrasonic Wind Tunnel, Contour (i=3.5)
h. Shock Wave Wind Tunnel, Contour (free flight test)
i. Shock Wave Wind Tunnel, Contour

Fig. 11. Towed Cone Drag Coefficient With Changes in M Number

Reference [30] supplied an engineering calculation method for the aerodynamic characteristics of the drag brake scheme, the influence of separation flow and entropy layer swallowing are taken into account in the calculations, the M number of the brake front and the dynamic pressure are corrected, but the influence of the three dimensional effect of the drag brake and the uneven flow field of the brake front were not taken into account. The calculation results of this method and the wind tunnel test results data basically conform (Fig. 12). For the hypersonic wind tunnel, the calculated critical purity ratio (about 0.38) and the test results are pretty much the same, but for the shock wind tunnel test situation, no critical purity ratio appeared in the calculated results.

Reference [31] studied the influence on the drag brake thermal environment and the changes in the drag brake erosion contours on the drag coefficient, and when the zhejiao is 45° and 60°, a high peak thermal flow appears on the brake. The shock wave wind tunnel tests[32] verified this conclusion. This may make the drag brake's windward side burn a cavity contour[33] and thus makes the drag coefficient drop rather more[34].

VI. Ballistic Analysis and Characteristics Comparison

For a typical reentry vehicle we carried out a ballistic analysis and characteristics comparison of each scheme. The geometric dimensions of each scheme were limited structurally. The ratio of the drag brake surface area and the bottom surface area in the drag brake scheme was 0.084. We found the drag coefficient of the schemes using wind tunnel test data smoothing and engineering calculations extrapolated to high M numbers (Fig. 13), for the prerecovery reentry vehicle's nonviscous drag coefficient we used the results of nonviscous value calculations, for friction drag and bottom drag we used the general experimental equation, and on this basis we carried out ballistic calculations for the schemes. What interested us in comparing characteristics was: 1. If a supersonic parachute was not used, the M number at an altitude of 2.5 km might be reduced to m = 1.0. 2. Landing velocity did not exceed 30 m/sec. 3. Change in the axial overload after reaching recovery altitude. 4. The dynamic when the parachute opened satisfied the demand that the parachute could open without destruction[2]. The time of the drag cone deployment was assumed to be 0, 0.5, and 1.0 seconds, respectively, the drag brakes were considered to have been opened to 54° once and first opened to 30°, with the reopening to 54° separated by 0.5 or 1.0 seconds.

The results of the calculations demonstrated that the aft jettison mass plus parachute scheme jettisoned 60 percent of the mass, and opening the parachute at M_∞ = 2, and recovery at an altitude of 7 km, the parachute drag coefficient of 1.0, could satisfy the demands of safe recovery, the maximum overload at the time of jettisoning weight was 142 kg, thus the advantages of this scheme are that it is simple, reliable, and the overload is small, the key problem is whether jettisoning this much weight is permitted in the design and structure of a supersonic parachute. For the drag cone scheme, let η be the ratio of the recovery body length and the length of the reentry vehicle, when η = 0.864, not jettisoning weight, beginning recovery only at 7 km can satisfy the demands, considering errors in the drag coefficient, only when η = 1.0 (not jettisoning weight) can the demands be satisfied. If it can be designed so that structurally at the time of jettisoning the length of the recovery body is reduced, frequently the increase in drag is not enough because the bottom area is too small and the purity ratio is increased. If η = 0.53, then the jettison weight is 50 percent, and cannot satisfy the demands. With the drag brake surface selected, under the drag brake scheme not jettisoning weight cannot satisfy the demands, η = 0.864, the time interval of the second brake opening is 1.0 seconds, only jettisoning 44 percent of the weight can satisfy the demands. For the sidewise jettison mass-drag cone scheme, if the recovery altitude is 7 km, jettisoning 30 percent of the weight can satisfy the demands, and had considerable

yuliang [5940 6852]. If 50 percent of the weight is jettisoned, the recovery altitude can be dropped to 4.5 km. Table 1 gives the typical data for each scheme for a recovery altitude of 7 km and jettisoning 50 percent of the weight:

Scheme	Sidewise Jettison	Towed Cone			Drag Brake	
	1.0	0.864		0.53	0.864	
t(sec)	0	0	0.5	0	0	1.0
$M_{H=2.5\ km}$	0.217	0.220	0.221	1.320	0.268	0.536
$H_{M=1.0}$	4.320	4.502	4.146	2.254	3.522	2.775

For the drag brake scheme, opening the brakes twice could clearly reduce axial overload. When Δt = 1.0 seconds, the maximum overload could be reduced 1/3, but velocity performance also was clearly lowered, and when the towed cone was released, it did not have a large influence on overload. This result is identical to the conclusions of reference [7] when the recovery body is a pointed cone. Calculations show that rationally designed recovery altitude and jettison weight ratio, the schemes could satisfy the demands of open parachute dynamics so that after satisfying the demand of M_∞ when H = 2.5 km, an ordinary parachute could satisfy the demands of landing velocity.

Actually, from Figure 13 it can be seen that as far as the drag coefficient of the several schemes is concerned, it is very difficult to come to any conclusion about which is best. However, as far as drag is concerned, another important factor is the diameter of the bottom. After jettisoning mass, the towed cone and drag brake schemes, are structurally arranged smaller than the bottom diameter of the sidewise jettison-drag cone scheme. For these two schemes, the structural problem of jettison weight has to be resolved, in addition, the problem of towed cone stability and drag brake thermal resistance are two aerodynamic problems which must also be resolved for these two schemes. At the same time, because the jettison weight and increased drag of these two schemes involved two actions, it increases the complexity of the control systems. For the sidewise jettison-drag cone scheme, jettison weight and increasing drag are carried out simultaneously by a single action, the demands on the control systems are reduced. However, for this scheme it is necessary to clarify the aerodynamic interference of the shell and the recovery body to avoid collision between the two bodies and excessive disturbance caused by the recovery body, if the reentry vehicle has a definite angle of attack before recovery, or if a nonsymmetrical separation occurs, the problem will be even more complex.

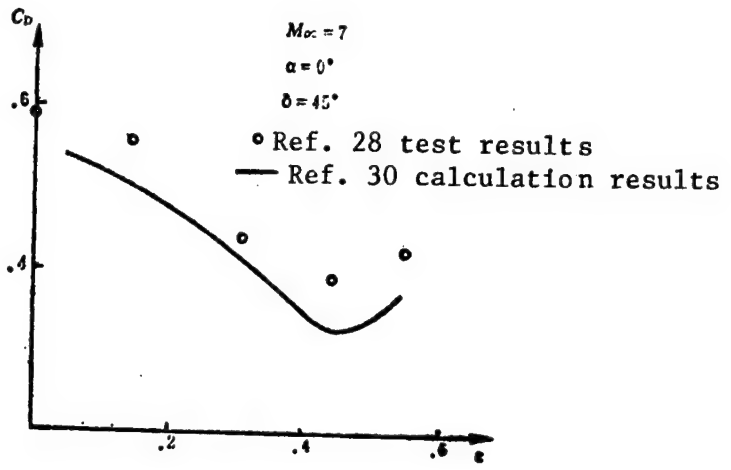


Fig. 12. Drag Coefficient of Drag Brake Scheme When M_∞ = 7 With Changes in the Purity Ratio

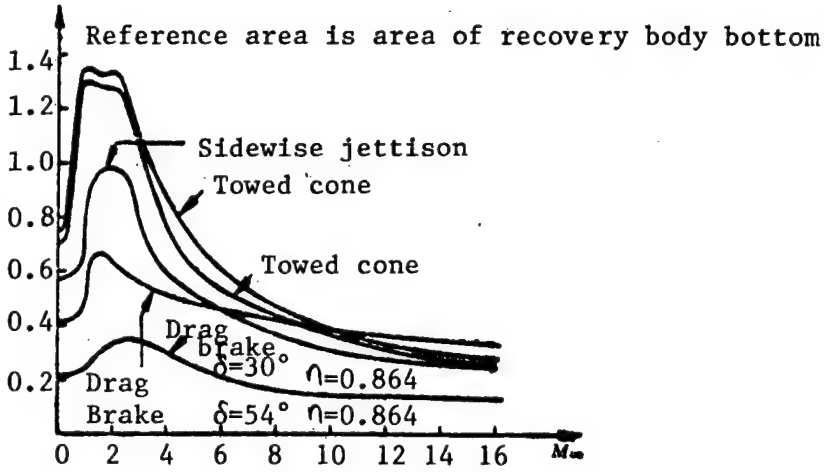


Fig. 13. Drag Coefficient Used in Ballistic Analysis of Each Scheme

VII. Conclusions and Proposals

1. Although the flow around the body of the recovery body in each of the recovery schemes has its own characteristics, all can produce open-type separation flow. If open-type separation flow appears on the recovery body, the drag coefficient clearly diminishes, and thus in design, the appearance of this type of flow should be avoided as much as possible.

2. At supersonic speeds, the drag coefficient of all the schemes drops with the M number, but the drag coefficient of the drag brake scheme drops comparatively gently with the M number. The drag coefficient of the schemes has a clear influence on the purity ratio of the recovery body. Changes in the duantou erosion contour also has a definite influence.

3. Ballistic analysis shows that the schemes can achieve similar deceleration effects. When choosing a scheme, the advantages and disadvantages of aerodynamics, structure, heat resistance, control, and demands on the parachute of each of the schemes should be weighed. Further research should be conducted on aerodynamic interference in the weight jettisoning process of the schemes.

4. After comprehensive analysis, the results of wind tunnel force, pressure, and heat measurement tests and free ballistic tests and the results of engineering calculations of these schemes can serve as a preliminary design basis. To obtain more reliable aerodynamic data, it is still necessary to improve the testing techniques for existing equipment, improve engineering calculation methods, research the numerical calculation methods of complex contour nonviscous and viscous flow, and at the same time create conditions for carrying our model free flight tests.

The relevant calculations of the comprehensive analysis in this paper were done by Comrades Zhang Xiaoli [1728 2556 7787], Xue Limin [5641 0448 3046], in the process of completing this paper we received the support of the Ministry of Aerospace Industry, the China Aerodynamic Research and Development Center, the Beijing Aerodynamic Research Institute, and the Chinese Academy of Sciences Dynamics Institute. Comrades Sun Yijun [1327 3015 0193], Cai Jinshi [5591 6855 3740], Wen Yongyuan [3306 8673 3293], Sun Hongsen [1327 3163 2773], Cao Wenxiang [2580 2429 4382], and Wang Jianli [3769 7003 5461] provided a great deal of help, and here we thank them as a group.

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APPLIED SCIENCES

NEW TOOL MATERIAL TO PREVENT SPARKS, EXPLOSIONS

Beijing JINSHU RECHULI [HEAT TREATMENT OF METALS] in Chinese No 10, Oct 85 pp 59-62

[Article by Wang Funian [3769 4395 1628]: "New Materials' Tool Materials for Preventing Sparks and Explosions"]

[Text] For a long time the places susceptible to combustion and explosions in the chemical, ordnance, automotive, petroleum, and other industries have all along continued to use repair tools made of iron. Under this condition during work, when operations are improper and striking occurs, sparks are easily generated leading to fires or explosions. Therefore there is very much of a need to study a new type of tool material that will prevent sparks and explosions. After more than a year of tests we have successfully developed a new type of tool material to prevent sparks and explosions; not only does it possess a rather high strength, hardness, and malleability, but its cost is also low.

1. Selection of Materials

Commonly used repair tools like adjustable wrenches, hand-held hammers, and various types of special-use wrenches for the most part use carbon steel in manufacturing. Their post-forging mechanical properties are 30 steel: $\sigma_b \geqslant 57 kgf/mm^2$, HB229; 40 steel: $\sigma_b \geqslant 62 kgf/mm$, HB241; and 45 steel: $\sigma_b \geqslant 65 kgf/mm^2$, HB241. When these tools strike they can generate sparks and cannot be used in places susceptible to combustion and explosions. According to document presentations, bronzing and aluminum bronze can satisfy this technical demand. However, the price of bronzing is expensive and cannot be easily employed for general-use repair tools. Based on document presentations, ZQA1 10-4-4 alloy-casting state properties are σ_b 50-60kgf/mm^2, δ_b 5-10%, HB200; ZQA1 11-6-6 alloy mechanical properties are σ_b 60-70kgf/mm^2, δ_5 1-2%, HB250. ZQA1 10-4-4 alloy strength is rather low and malleability is good. ZQA1 11-6-6 alloy strength is high and malleability deficient. We have referred to the alloy composition of the two above-mentioned and have selected Al, Fe, and Ni as the primary alloy elements, and to abate further the characteristic of aluminum bronze's slow-cooling brittleness and to enhance its strength and malleability

we have appropriately added a small quantity of manganese. The mechanical properties of aluminum bronze after it was improved were in the range of ZQAl 10-404 and ZQAl 11-6-6, and its physical chemistry properties corresponded to them. The mechanical properties of this kind of alloy during its casting state are $\sigma_b \geqslant 73$kgf/mm, δ_{10} 5-7%, HB 243-261, a_h 2.5-3.5kgf.m/cm^2, and τ_b 56kgf/mm^2.

2. Smelting Characteristics

(1) Addition of alloy elements. When adding alloy elements it is necessary to stir so as to avoid generating segregation. When adding aluminum to the copper liquid a violent exothermic reaction can occur. To avoid the solution temperature from getting too high you can add while mixing.

(2) Casting. Repeated experiments have made clear that a metallic permanent-mould casting is much better than a sand mould casting. If the melting temperature of this kind of alloy is excessively high, coarse crystals will easily be generated. Under a normal casting temperature the metallographic organization of casting alloys consists of thin and well-distributed alpha and beta phases which approach small granular ferrous grains. See Figures 1a and 1b.

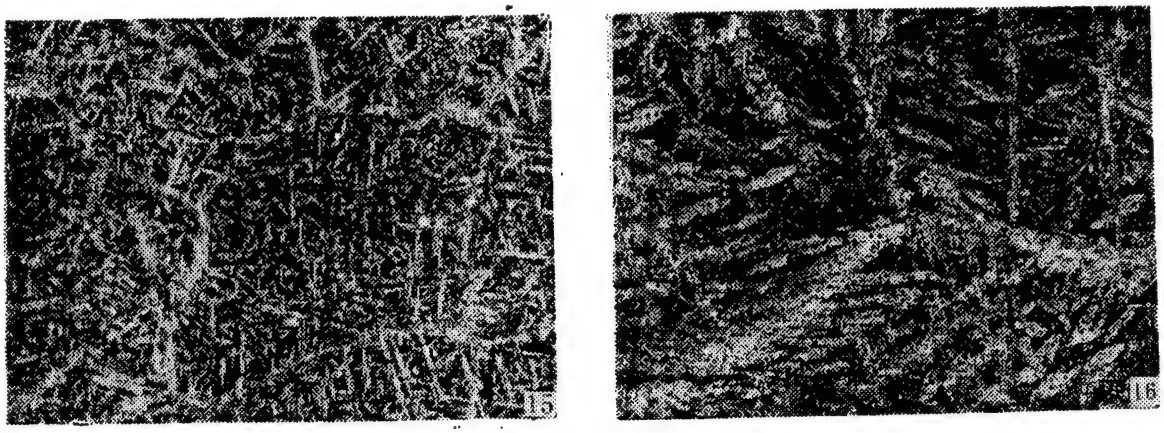


Figure 1. Metallographic Organization of Alloy Casting State x200.

(a) Metallic-mould casting (HB280) (b) Sand mould casting (HB240).

(3) Special points of congealing. The scope of this kind of alloy-crystallizing temperature is rather narrow. Its congealing characteristics approach pure metallic-layer congealing and the fluidity is good, but the volume contraction is great, which easily forms concentrated contraction cavities and does not easily form interdendritic segregation. Due to the fact that the aluminum content of the alloy is fairly high, Al_2O_3 inclusions are easily formed. This is especially so in the formed secondary oxides during the course of casting, which is very difficult to remove from the casting and seriously affects the quality of the casting. Therefore there should remain a sufficient rising head.

(4) Annealing brittleness. If the casting is improper, hard and brittle eutectoids ($a+\gamma_2$) will easily be separated out in the organization. This is due to the fact that when the alloy is at 565°C there occur eutectoids which transform $\beta \rightleftarrows \alpha + \gamma_2$, and the speed of transformation is rather fast. At the time when the casting wall is rather thick and the speed of cooling rather slow there is still greater beta phase breakdown, making the casting become brittle and presenting naphthalene state coarse-grain fractures. To prevent annealing brittleness and to allow the alloy organization to obtain thin and well-distributed alpha and beta-phase integral well-distributed grains and ferrous grains, after casting you should open the oven as early as possible and allow the casting to be placed in the air for cooling (it is best to open the oven at 500-600°C and immediately water-cool). Moreover, within the alloy it is appropriate to add amounts of Fe, Ni, and Al elements, which can concurrently enhance the alloy hardness and malleability.

3. Metallic Organization and Mechnical Properties

(1) Casting state. The metallic-phase organization of metallic mould-casting alloys is ($\sigma+\beta$) phase-integral small granular ferrous grains (see Figure 1a). Its mechanical properties are σ_b78-88kgf/mm^2, δ_{10}4-10%, HB280, and a_h5.6kgf.m/cm^2.

The metallic organization and mechanical properties of sand mould casting alloy are $\alpha+\beta$ phase-integral small granular state ferrous grains (see Figure 1b). Its mechanical properties are σ_b73-78kgf/mm^2, δ_{10}5-7%, HB243-261, a_h2.5-3.5kgf.m/cm^2, and τ_b56kgf/mm^2.

(2) Forging. This kind of alloy can undergo a hot forging processing. The temperature at the beginning of forging is 900-920°C, and the temperature at the end of forging is 650-750°C. After forging, the metallic-phase organization is even more thin and well distributed and it has improved upon the original casting state organization. The post-forging metallic-phase organization of sand mould-casting alloys is the granulated-state $\alpha+\beta$ phase of small granular ferrous particles (see Figure 2). Its mechanical properties are σ_b79-88 kgf/mm^2, δ_{10}3-7%, HB280-380, α_h5.1 kgf.m/cm^2, and τ_b73kgf/mm^2.

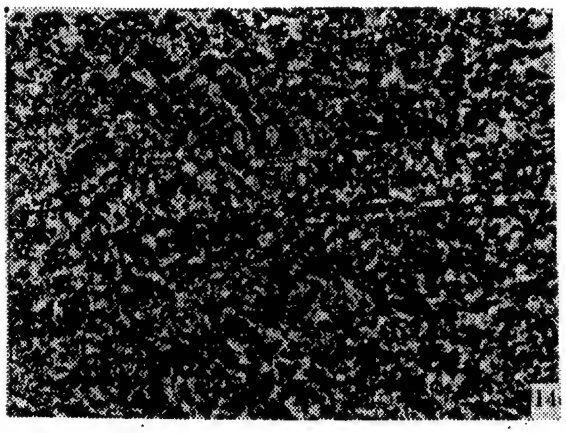
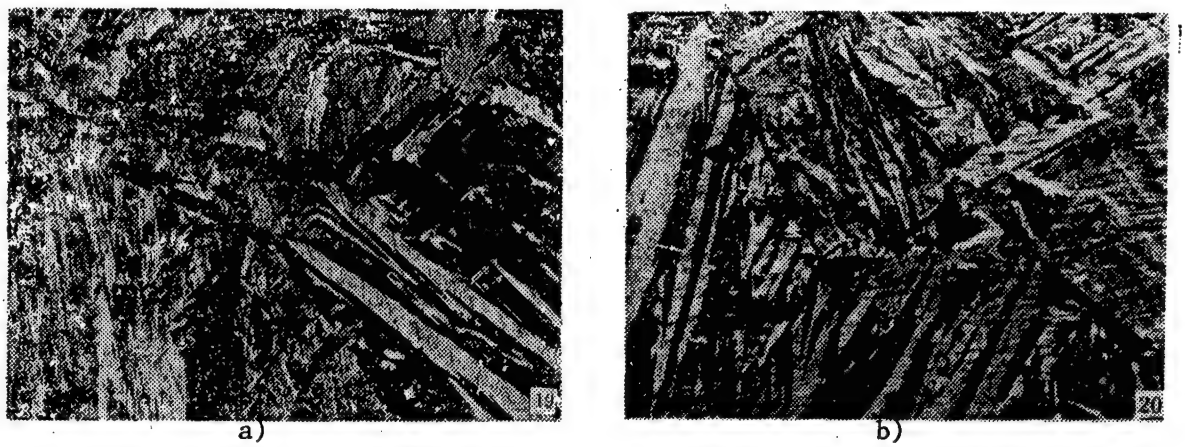


Figure 2. Alloy Hot Post-Forging Metallic Organization of Sand Mould Casting (HB380) x500

(3) Heat treatment. By heating the alloy to 920°C, with heat preservation at 2h, and by tempering it by dipping it into water at 20-25°C, you will obtain a xiang steel-annealing martensite-state metastable $\beta 1$ phase organization. Under a microscope you will observe a $\beta 1$ phase which assumes a needle shape. If the $\beta 1$ phase is scattered and well dispersed and the quantity is appropriate you can enhance the alloy composite mechanical properties. But if the 1 phase is too great and too coarse you will make the alloy become brittle. Therefore, this kind of alloy may employ heat treatment to improve its organization and performance (see Figures 3a and 3b). If the annealing organization is too hard and too brittle it will have no useful value and it must undergo heat preservation at 650°C 2-3h and return to the fire for treatment before it can be used.



a) b)

Figure 3. Metallic Organization of Alloys After Tempering x200. a) Metallic organization of (HB320) sand mould casts after tempering. b) Metallic organization of (HB354) metallic-mould casts after tempering.

After sand mould castings are tempered you can obtain a needle state $\beta^1 + \alpha$ organization and small granular Fe particles (see Figure 3a). The metallic-phase organization at 650°C after being returned to the fire is still the $\alpha+\beta$ phase and small granular Fe particles. However, it is finer than the casting state organization (see Figure 4a). Its mechanical properties are a hardness at HB323-340 after being tempered by dipping in water. After return fire treatment at 650°C it is HB225, α_h 5.6kgf.m/cm^2.

The organization of post-alloy heat treatment by using metallic-mould castings is the same (see Figure 3b and Figure 4b). Its hardness of HB353 is the hardness of HB261 after returning to the fire at 650°C. The metallic-phase organization of metallic-mould casting alloys after they have undergone additional heat to 950°C has been tempered by dipping into water, and after being returned to the fire at 650°C it is much finer than sand mould castings. That alloy also may after maintaining a temperature of 650°C at 2-3h be directly tempered by dipping into water. In this way you can obtain the organization of xiang steel's hodograph physical state. Because there is no phase change there is no brittle phase. You need not undergo tempering treatment and its hardness is HB267 (see Figures 5a and 5b).

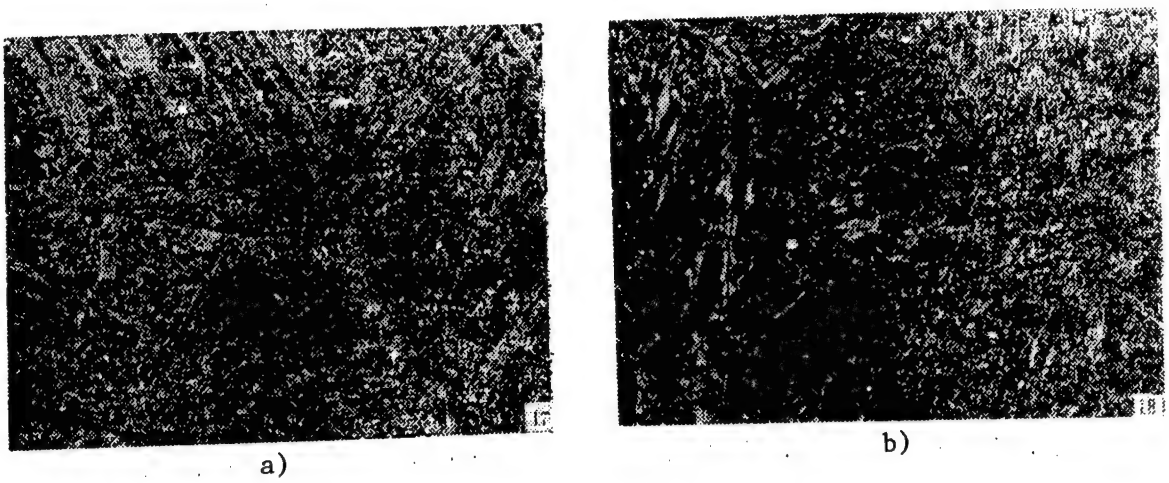


Figure 4. Metallic Organization of Alloys After Tempering by Returning to the Fire x 500. a) Sand mould casting tempering and metallic organization of (HB245) after returning to the fire. b) Metallic-mould casting tempering and metallic organization of (HB267) after returning to the fire.

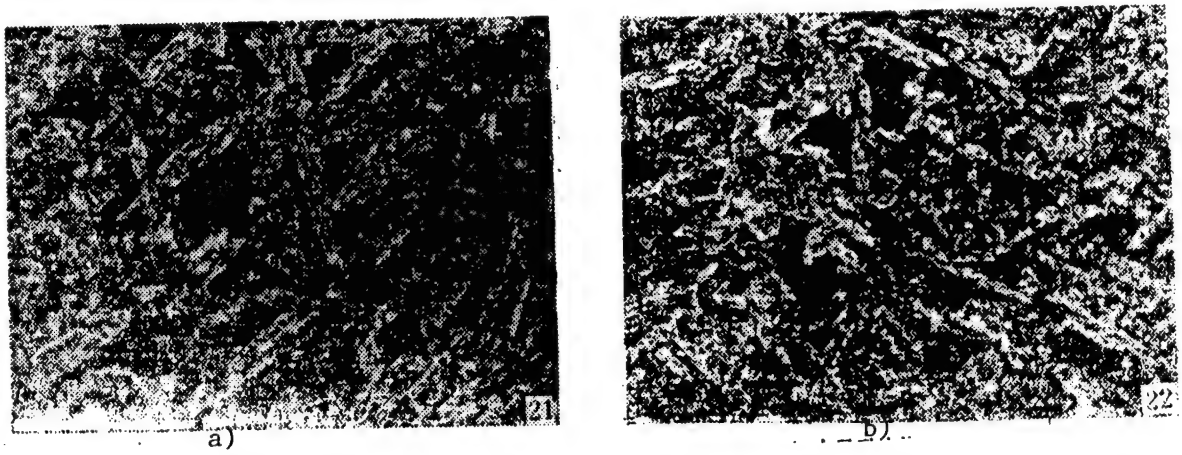


Figure 5. Organization of Alloys Undergoing Tempering at 650°C and Not Being Returned to Fire x 500. a) Sand mould casting (HB245). b) Metallic-mould casting (HB726).

Although the hardness of this kind of steel has not been enhanced much after undergoing water quenching at 650°C, after treatment the metallic-phase organization is much finer than the casting-state organization and its composite properties also have obviously been enhanced.

4. Applications and Existing Problems

(1) Under any condition this kind of alloy will not generate sparks when struck and it has sufficiently high strength, hardness, and malleability in order to be manufactured as an appropriately utilized repair tool such as hand-held hammers, adjustable wrenches, special-use wrenches, screwdrivers, etc. in places susceptible to combustion and explosions. After more than 1 year of being put into production the use effect has been good and they are completely safe and reliable.

(2) This kind of alloy has comparatively high strength, hardness, wearability, and good technological properties and corrosion resistance. Moreover, under temperatures of 500°C these properties may be maintained. Therefore they may also be used as wearproof, corrosion-resistant spare parts under conditions of high temperature and pressure.

(3) This kind of alloys's shrinkage is great. Therefore during forging you must leave sufficiently large casting heads before you can maintain the quality of the product.

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URBAN, RURAL ENVIRONMENTAL WORK FOR 1986 OUTLINED

Beijing JIANZHU [BUILDING CONSTRUCTION] in Chinese No 2, 7 Feb 86 pp 8-10

[Article: "Urban and Rural Construction and Environmental Protection Work in 1986"]

[Text] Urban and Rural Construction and Environmental Protection Vice Minister Comrade Lilan Zhong [1670 0112], at a meeting with the national construction commissioner and the director of the construction committee on 18 December 1985, outlined the work ahead for 1986. He pointed out that 1986 being the first year of the Seventh 5-year Plan, we want, on the basis of the success achieved by the Sixth 5-year plan, to grasp reform, establish confidence, overcome difficulties, forge ahead positively, and raise every aspect of work to a new level.

1. Strive to Enhance Economic and Social Benefits of the Construction Industry

In 1986, the central responsibilities of the construction profession are: deep organizational reforms, consolidation of the construction market, improvement in the style of management, assurance of engineering quality, and improvement of economic and social benefits.

Regarding deep system reforms, the main thing is to continue to pursue contracts through public bidding; this is the most important reform measure and should be carried to completion. From now on, new engineering projects in general must implement public bidding of contracts. Those which still do not meet this requirement must break down the barriers and the monopolistic situation and positively create the conditions for this reform. Responsible departments of urban and rural construction of all levels must strengthen the management work dealing with both the solicitation and submission of bids. Together with other concerned departments, they must earnestly examine the bidding organization, reasonably judge and decide bids, guard against lopsided pressure to give preference on the basis of the low bid alone, insist on equality among bidders, and be fair in judging bids and reasonable in deciding upon bids.

One successful change is the realization that responsibility for a job is contained in the value of production wages; we must insist on perfection. The key to perfection is to be in accord with advanced principles: a more equitable setting of the wage coefficient and the figuring of the rate of progress, engineering costs, and so forth into the value of production wages,

both of which we should consider as substantial engineering factors. We especially want to raise engineering quality. But the situation of increasing material costs and higher wages makes these goals unreasonable; we must eliminate this situation. We must also insist on the use of system reforms in labor. In the long run, extensive use of rural construction brigades and the establishment of a cooperative system of urban and rural contingents are suitable for our country's conditions and our strategy of reform measures. From now on, we must concentrate on solving these problems. First, we must use perfected methods; some use a combination of fixed-salary labor and contract and temporary labor and use either this division of labor or assign work independently to rural construction brigades. Second, we must raise the wages and benefits of contract and temporary workers. Third, the unit handling the job must strengthen the management of contract workers, temporary workers, and rural construction brigades.

We want to carry out and perfect every aspect of economic responsibility. From now on, pay attention to perfecting, completing, and publicizing our work. Chongqing's municipal building code task and the management of the contractors and the contract system in Shenyang City have been relatively successful; this has been an experience of widespread significance. Its central theme is to use a small basis to figure units, to separate the authority for the means of production from the management authority, to carry out collectivist group contracts, and to allow teams to figure profit and loss and adhere to labor distribution and democratic management.

We must promote creativity. Of central importance is to raise quality; we must advance and pay attention to design changes. Right now, we need to pay attention to the correct handling of good quality and quantity and the connection between speed and benefit; we insist that the priority is to improve the quality of design; we must advance and be actively involved with creative construction; and we must speed up the replacement of the old with newer products. Distribution systems must be beneficial in raising design quality as well as advantageous in raising comprehensive benefits and the level of creativity. Right now, a few design units seek production value and income whole totally ignoring quality in their methods; they should quickly change their attitude. We must do investigations and research to solve our spare-time design problem; we can use the contract directives and plans discussed above to get from the unit the correct amount and egree of organization needed to carry out spare-time design. The individual can then be given the appropriate renumeration.

A priority activity in 1986 must be adjustment to the construction market and a conscientious effort to deal with present urgent problems to advance cadre, market, and professional management. (1) In adjusting the construction market, we must, in the beginning, insist on the elimination of illegal activity such as unlicensed designers, unlicensed construction workers, the taking on of work by underqualified people, fraudulent practices, misrepresentation of professional qualifications, etc. If these things cannot be accomplished, the confused situation in the market will be impossible to change. Those responsible for checking qualifications have not done a good job in this area and they must grasp this opportunity to perfect this business. The responsible

department will soon establish a method related to checking the qualifications for the construction of factory components and the construction of individual houses. After everyone receives it, they should rapidly arrange for its implementation. (2) Regarding all kinds of bad elements and swindlers who profit from this kind of illegal activity, we must dare to have them arrested and handle the investigation. (3) We must strengthen the management of urban and rural construction ranks. Regarding the assignment of rural construction teams coming into the city under contract, we must be careful about registration, check out qualifications, contract the task, and stress safety education and every aspect of quality control; we want to manage all this in a united way through the municipal jurisdiction. Regarding contract tasks of urban construction ranks throughout the province, we must get evidence of the quality of those going outside the district and do a thorough investigation of those coming into the district. (4) We must strengthen professional management. The key cities we want to publicize are Chongqing, Nanjing, Nanchang, Shenyang, etc., particularly in the areas of organization of city management and their experience with united management in the construction industry. The top offices in the country should also strengthen professional management and, based on the existing organizational personnel, adjust and set up the management of the administrative organizations for all professions. (5) We must perfect industrial management. We want to carry out modernization positively and adopt scientific management ideas, organization, methods, and measures. We want to put into play highly efficient management, create the greatest benefit, and conscientiously act upon improvements in industrial management.

In regard to raising the quality of engineering, we certainly want outstanding results in 1986. We must pay attention to these three things: first, we must correct the guiding ideology of industrial management. We must raise engineering quality and place it in an outstanding position. We must insist on precise work, good work, and fast work, and we must be thrifty. Second, we must set up a perfect engineering quality control organization. Supervisory stations of all levels must seriously carry out their duty, strictly carry out the law, and be genuinely effective. Third, we must have a system of quality assurance in industrial internal departments, thoroughly educate and develop quality awareness, and form a strong basis for improvement to raise engineering quality continuously. From company managers and technical offices to production teams, we must all build many administrative levels of a responsible system which will clearly reward and punish. In judging engineering quality, we must adhere to nationally issued technical regulations and standards for guidance; all engineers must establish technical files and also assure that technical information is correct. Basic engineering materials, components, and products must be examined and receive a certificate of suitability before leaving the factory; if one does not have that certificate, then the item must be reexamined until it passes. Unsuitable engineering quality cannot be reported on a schedule nor can it be considered as finished work and figured into the production value; it must be returned and the work redone.

2. Vigorously Pursue the Urban Program, Construction and Management Work

In 1986, we want to center on the urban capability to develop central motivation and diversified functionality better, continue to pay attention to the formulation and implementation of the urban program, organize reform of the urban construction system, grasp solutions to certain urgent urban problems, positively pursue each efficacious economic policy of urban construction, quicken the pace of residential commodity spending, set up reform experimental point for housing systems, and raise the urban program, construction, and management work to a new level.

Central to wanting to pursue residential commodity spending is a sense of conscientiousness about city and town residential construction and real estate management and administration work. First, we must pursue residential commodity spending and reform the housing system. Second, we must continue to grasp the policy of implementing private savings. Third, we must pay special attention to the nationwide urban and rural housing survey. Fourth, we must strengthen the real estate market and real estate industry management. Real estate management departments of all levels must bring governmental functions into full play, implement government/industry separation, reform the system of government/industry interaction in management, be geared to the needs of all industry, and vigorously enact the real estate development program, policies, legislation, organization coordination, etc.

3. Important Points on Construction in Market Towns; Pay Special attention to the Village and Town Construction Program and Design Work

Concerning village and town construction work, of importance are these types of considerations: first, we want to base the previously drawn-up village and town program on economics, carry on supplemental adjustments of social development requirements, and proceed deeper and in more detail to the formulation of a construction program. Second, we must strengthen program management, incorporate beneficial control over land for peasant home building, work out control criteria for use by rural town enterprises, and firmly redress the phenomenon of the rural-town industrial takeover of farmland. Third, the three levels of province, district, and county must layer upon layer pay close attention to the unified program for market towns, engage in comprehensive development experiments, obtain experience, and progressively publicize. Fourth, we must vigorously raise the level of archetectural design in villages and towns of all types. We especially want to provide diversified styles of peasant residential designs which conform to local characteristics.

4. Important Points Regarding Comprehensive Renovation of the Urban Environment; Bring into Play the Whole Environment Protection Department, Supervise Activity, and Strengthen Environmental Management

Regarding new construction, reconstruction, expansion projects, etc., we want to step ahead and strengthen environmental supervision management. Large and mid-size projects should strive for 90 percent simultaneous achievement in these three areas; small projects should strive for over 60 percent absence of pollution or for a low level of pollution. In developing the coastal cities

and other economically important areas, we want to be especially careful in dealing with environmental protection and create a favorable environment for investment.

Regarding rural enterprise, we want to propagate vigorously and carry out general and specific policies concerning the prevention and control of pollution.

5. Carry Out Thorough Reform of Drafting and Surveying Systems; Expand Scope of Draftingn and Surveying Services

All levels of departments responsible for drafting and surveying must realistically strengthen their macroscopic direction and adhere to the management system. Pay attention to all facets of formulating reform measures. Use the connection between the bidding system and economic reform to break through, fix new drafting and surveying production quotas, and formulate a set of drafting and surveying product prices. We should prepare for construction with a file network for storage of drafting and surveying materials nationwide. Regarding the expanded scope of service, an important point is to carry out land survey experiments, summarize the experience, formulate land survey technology standards and criteria, and, moreover, provide all the required technological equipment for an expanded scope of services.

6. Step Forward and Strengthen Legislative Work

In 1986, we want to promulgate several laws and regulations. For example, the "installation of a national unified architectural labor quota" and that of a "national unified municipal engineering labor quota" are two types of quota-related administrative methods we hope to attain. We should strive to work to completion and also report on laws and regulations. Pay attention to rough drafts of amendments to laws and regulations. At the same time, we do not want 1986 to be a year of investigation and research. We should strive to advance a clear, integrated, and systematic program of urban and rural construction and environmental protection laws and regulations.

7. Pay Close Attention to System Reforms in Science and Technology; Improve Level of Technological Equipment for Every Profession

An important point in regard to science and technology system reform is the reform of the management methods of annual planning. We must establish a science and technology development fund and solve the problem of inequitable distribution of income among research units. Research workers must pay close attention to the task of satisfying the urgent requirements of construction and environmental protection, organization of power, and development of strategy. We especially want to pay attention to the timely, publicized, and responsive achievements we have already made in scientific research. Moreover, we must energetically and reliably develop cooperation and communication with foreign science and technology groups.

8. Pay Attention to Development of Education; Train Person, Then He Can Work

There are three aspects of this work which we want to do well. First, we must pay attention to secondary technical education and make adjustments in

the structure of secondary and higher technical education. Current secondary schools must expand their scope. Provinces which have not built municipal secondary technical schools must prepare to do so and quickly realize the "two schools per province" pattern. In places where conditions permit, we still want to prepare for the construction of secondary technical schools in villages and towns. My department and the Central Radio and Television University have cooperated in three locally built secondary technical schools of television which will soon be open for registration. Each district and each unit must strive to do the registration work for the secondary technical schools of television. We must energetically take care of secondary technical correspondence schools, workers secondary technical schools, workers schools, and secondary technical self-study examinations. We must utilize many types of communication channels and train mid-level, technically capable workers. Second, we must progressively set up a standard system of assuring workers' training. In 1986, we must continue to pay close attention to the preparatory construction by my department of a cadre management institute. We also must, one by one, formulate professional standards, relevant educational programs, educational outlines, and educational materials for all levels and all types of cadre positions. Third, we must continue to reform the hiring system and strictly implement the "first train, then work" rule. Fourth, under the premise of quality assurance, we must have a sustained, steady development of directly subordinate, higher education facilities.

9. Vigorously Strength Spirit, Culture, and Construction; Perform Well on Political and Ideological Work

Regarding our paying attrention to spirit, culture, and construction and the central theme of strengthening political and ideological work, we must strive for awareness of both the party's and society's mood for a basic change for the better. All levels of paty work groups must directly face the present problems, and take care of the policies, ideals, regulations, legislation, and moral education of the workers. At the same time, all professions together must carry out reforms in the ideological direction and education of management work style education to make workers more self-disciplined, oppose all dishonest practices and the decadent management attitude that profit comes before anything, and resist and fight against the "money is everything" mentality and the self-centered, not group-centered, behavior which is not concerned for, and may even hurt, national interests.

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PROMOTION OF HYDROPOWER STATION OUTPUT AND RECEPTION OF GENERATOR LOSSES BY USING HEAT-PUMP AND REFRIGERATION SYSTEM

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 2, May 85 pp 117-120

[English abstract of article by Zhong Shiming [6988 0670 2494] of Nanjing Institute of Technology]

[Text] This paper discusses the use of HPRS to raise hydropower station output and to receive generator losses, which is an effective measure. Analysis of three HPRS's developed by the author shows that the primary source cost-exergy efficiency when the air compressor HPRS approach is used is less than that of the boiler space heating approach, but by using the F-12 steam compressor HPRS, the efficiency is the highest, 5.2 times higher than that of the boiler space heating approach and 4.5 times higher than that of the air regenerative compressor HPRS.

QUASI-THREE-DIMENSIONAL DESIGN AND FULL THREE-DIMENSIONAL ANALYSIS CALCULATIONS IN TURBOMACHINES

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 2, May 85 pp 125-129

[English abstract of article by Wang Qinghuan [3076 1987 2719] and Zhu Genxing [2612 2704 5281], et al., of the Institute of Engineering Thermophysics, Chinese Academy of Sciences]

[Text] Progress in the development of quasi-three-dimensional and full three-dimensional numerical solutions for steady subsonic rotational flow through turbomachines is presented. An iterative calculation between the flow on a mean hub-to-tip S_2 stream surface and a number of blade-to-blade S_1 stream surfaces gives the quasi-three-dimensional solution, which is very easily extended to five a full three-dimensional solution by merely calculating a few more S_2 surface flows and relaxing the restriction that S_1 surfaces are surfaces of revolution. A new S_2-S_1 iteration scheme has been developed and employed in the present code. An automatic computing system is used, which first computes the quasi-three-dimensional flow for blade design and then computes the full three-dimensional flow for the blade row just designed.

The results obtained by applying this computing system to the design and determination of the full three-dimensional flow field of a two-stage axial compressor and a high subsonic compressor stator are obtained and show the difference in the flow field between the quasi-three-dimensional and full three-dimensional solutions.

EXPERIMENTAL RESEARCH ON SECONDARY FLOW IN RECTILINEAR TURBINE CASCADES

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 2, May 85 pp 130-135

[English abstract of article by Ye Dajun [0673 1129 0971], et al., of Qinghua University]

[Text] In order to study the secondary flow in a turbine cascade the flow field is measured in detail. The measurements of pressure and velocity are taken at various axial planes upstream of, within, and downstream of the cascade by a four-hole probe. The static pressures are taken on the endwall and suction and pressure surfaces. Through experimental data, the mechanism of the secondary flow field and the loss model are proposed in this paper.

THE OSCILLATING MEAN STREAM LINE METHOD TO DETERMINE UNSTEADY FLOW ABOUT VIBRATING CASCADE

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 2, May 85 pp 145-147

[English abstract of article by Chen Zuoyi [7115 0146 0001], Duan Qiusheng [3008 4428 3932], Duan Shizhong [3008 0013 1813] and Zhu Zhiguo [2612 3112 0948] of Qinghua University]

[Text] In this article we expand the idea of mean stream line to determine the unsteady flow about the vibrating cascade. The physical model of the oscillating stream line and the "Oscillating Mean Stream Line Method" are presented. Based on the unsteady energy equation, the variation law of oscillating parameters along the mean stream line can be determined, and that along the pitch can be determined from the unsteady mass conservation, irrotational and boundary conditions. Thus we have obtained the unsteady flow solution about a vibrating cascade.

EFFECT OF DIRECT HEATING ON COMBUSTION EFFICIENCY OF JET ENGINE CHAMBER IN SIMULATION TEST ON THE GROUND

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 2, May 85 pp 187-190

[English abstract of article by Yu Shouzhi [0060 1343 1807] and Lin Guohua [2651 0948 5478], et al., of Beijing Power Plant Research Laboratory]

[Text] A calculation method of the combustion efficiency from a theoretical model has been developed to show the effect of direct heating, which produces pollutants in pure air, on the combustion efficiency of a jet engine combustor. This theoretical equation is proven using a large number of experimental data from models of conduct combustors and main combustors of jet engines and from the testing combustor. The equation of semiexperience for engineering, which can calculate the efficiency of combustion in the case of pure air from the experimental results for different polluting conditions, has been obtained.

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CALCULATION OF EXTERNAL AND INTERNAL TRANSONIC FLOW FIELD OF THREE-DIMENSIONAL S-SHAPED INLET

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 4, Nov 85 pp 321-325

[English abstract of article by Ji Minggang [4764 0682 0474], et al., of Northwestern Polytechnic University]

[Text] A mixed finite difference method for calculating the external and internal transonic flow field around an s-shaped inlet is presented. The equation of the full velocity potential in cartesian or cylindrical coordinates is used as the governing equation. As the method used for the present analysis separates the coordinate system and the geometry, the mesh points may not lie on the body surface. The boundary condition is satisfied by the mesh points which are situated in the vicinity of the wall. An improved analytical continuation method is developed to treat the boundary condition at solid face. A linear under-relaxation procedure is used in calculations. The relaxation process is marched forward axially from one part to another in sequential order. The calculations are repeated until the change in the velocity potential between relaxation sweeps is less than a preassigned value and the conservation of mass flow between cross sections in the inlet is reached.

Computations have been made for an s-shaped inlet with free stream Mach number $M = 0.8$ at different angles of attack and yaw. The computed results are compared with those computed by the perturbation method and with experimental results. This comparison shows that the present method is promising.

DESIGN IMPROVEMENT AND TEST RESEARCH OF CENTRIFUGAL PUMP

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 4, Nov 85 pp 326-330

[English abstract of article by Liu Diankui [0491 3013 7608], et al., of the Institute of Engineering Thermophysics, Chinese Academy of Sciences]

[Text] Based on Professor Wu's three-dimensional flow theory, the design improvement of a pipe inline pump has been done for the first time. The test results are as follows: the efficiency of the pump increases from 68.5 percent to 72.9 percent at design capacity and the best efficiency of the redesigned pump is about 75 percent. It is proven that the three-dimensional flow theory has great potential for improving pump design.

FINITE VOLUME METHOD TO SOLVE INVERSE PROBLEM FOR TRANSONIC FLOWS IN CASCADES

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 4, Nov 85 pp 331-335

[English abstract of article by Zhou Xinhai [0719 2450 3189], et al., of Northwestern Polytechnic University]

[Text] A finite volume method to solve the inverse problem for transonic flows in cascades is described in this paper. This technique can be used to design the blade profile with prescribed pressure distribution at the blade wall. The paper presents the system of equations to be solved and the discretization scheme. The approach to modify the profile shape, calculation of the wall pressure and solution procedure is discussed in some detail. Some computed results of transonic turbine cascades are presented to illustrate the method's capabilities.

IMMERSION COOLING AND JET IMPINGEMENT COOLING OF MICROELECTRONIC CHIPS

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 4, Nov 85 pp 355-360

[English abstract of article by Ma Chongfang [7456 6850 5364] of Beijing Polytechnic University]

[Text] An experimental apparatus for studying chip cooling was developed and is described. The fundamental characteristics of immersion cooling and jet impingement cooling have been investigated. Natural convection, pool boiling and impingement heat transfer with and without boiling and burn-out were the heat transmission modes encountered in the cooling techniques. It was found that the free convection heat transfer coefficients for a chip-size heater were as high as four times the predicted values. A new hysteresis phenomenon, never before presented in the literature, was discovered. For jet impingement cooling, initial, partial and fully-developed nucleate boiling and burn-out were studied experimentally. Some practical formulae are recommended for cooling system design.

RESEARCH ON NATURAL CONVECTION BETWEEN HORIZONTAL CONCENTRIC CYLINDERS WITH ADDED MATERIALS

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 4, Nov 85 pp 370-372

[English abstract of article by Jiang Yu [1203 3842], et al., of the University of Science and Technology of China, Hefei]

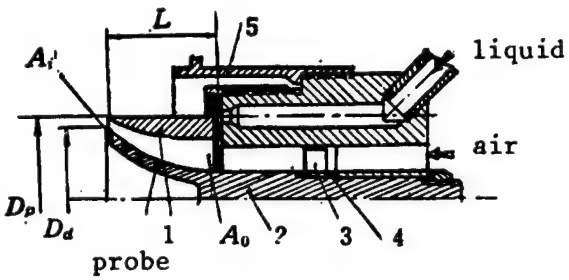
[Text] In this work a study of laminar natural convection in the horizontal annulus with added solid materials has been done by both computational and experimental methods. The theoretical temperature and velocity distributions are presented. The fluid temperature field is also obtained by holographic interferometry. The experimental results were in good agreement with those calculated by the numerical technique. This proved that both experimental and numerical methods are appropriate for studying this kind of problem. Results reported in this work can be used for thermal insulation techniques using air as an insulation material.

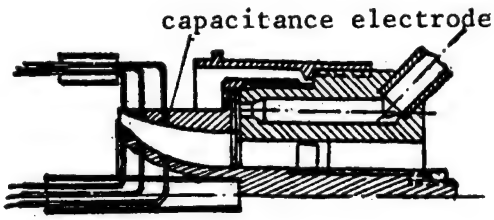
STUDY OF LIQUID FILM THICKNESS INSIDE AIRBLAST ATOMIZERS

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS]
in Chinese Vol 6 No 4, Nov 85 pp 378-384

[English abstract of article by Zhao Qishou [6392 0366 1108], et al., of
Beijing Institute of Aeronautics and Astronautics]

[Text] The performance of liquid film thickness has been research theoretically and experimentally. A theoretical formula of film thickness of the liquid inside the atomizer was derived by thin shear layer equations. As a consequence, the key parameters dominating the film thickness h, especially the parameters of atomizer geometry, were found. From experiments an empirical formula for h was determined and it was found that the theory of film thickness agreed with the experimental results better. Some other factors, such as the initial amount of liquid swirl and airstream swirl in the atomizer, were also investigated.





STUDY OF CHARACTERISTICS OF BUBBLE IN FLUIDIZED BED COMBUSTOR

Beijing GONGCHENG REWULI XUEBAO [JOURNAL OF ENGINEERING THERMOPHYSICS] in Chinese Vol 6 No 4, Nov 85 pp 385-388

[English abstract of article by Hong Yanhua [3163 3601 5478] of Zhejiang Energy Institute; Chen Jiong [7115 3518] and Zhang Xuehong [1728 1331 1347], et al., of Zhejiang University]

[Text] A fluidized bed combustor uses coal with broad size distribution as fuel and operates at high temperatures. However, there is a dearth of information concerning bubble properties under such conditions.

Based on the theoretical pressure field around a bubble in the fluidized bed derived by Davidson, we have developed a new pair of pressure probes located on common vertical axes to measure the bubble parameters: bubble rising velocity, bubble depth (diameter), bubbling frequency, etc. The pressure fluctuation signals received from a cold model and a combustor have been analyzed by statistical methods with the help of a computer. Correlation of the bubble parameters to solid properties and flow conditions by linear regression analysis results in the empirical equations. The results show that there is a great difference between bubble parameters in the cold model and a real combustor.

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STUDY OF PROPERTIES OF CHINESE LARGE BGO CRYSTALS AS MATERIAL FOR ELECTROMAGNETIC CALORIMETRY

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 10 No 1, Jan 86 pp 1-8

[English abstract of article by Gu Yifan [7357 0110 5672] and Zhu Guoyi [2612 0948 5030], et al., of the Institute of High Energy Physics, Chineae Academy of Sciences; and Shen Dingzhong [3088 1353 0022], et al., of Shanghai Institute of Ceramics, Chinese Academy of Sciences]

[Text] Preliminary results on the properties of Chinese long BGO crystals for detection of photons are presented. Twenty-nine crystal samples grown by the Bridgman-Stockbarger method are superior overall to foreign products of similar size in energy resolution, light output and quality stability. The light output uniformity along the crystal length reaches a level of ±1 percent. Various wrapping conditions are compared and geometric effects are studied.

RESEARCH FOR THE POSSIBILITY OF ACOUSTICALLY DETECTING COSMIC RAY PARTICLES

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 10 No 1, Jan 86 pp 9-14

[English abstract of article by Jiang Yinlin [1203 0603 3829], et al., of the Institute of High Energy Physics, Chinese Academy of Sciences; and Song Jianning [1345 1696 1337] of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] Results of experiments exploring the possibility of acoustically detecting cosmic ray particles are reported. It is shown that the ultrasonic background noise is very complicated, and some individual and transient ultrasonic signals exist in natural waters. The mechanism producing these signals may be the sound radiation of the microbubbles in the water. There is no evidence supporting the possible correlation between these signals and cosmic ray particles. The threshold energy of acoustic detection of EAS core is above $3 \cdot 10^{16}$ eV at sea level and that of the local showers produced by cosmic ray particles is above 10^{14} eV.

ON THE BOUNDARY CONDITION AND CANONICAL S-WAVE HAMILTONIAN FOR THE DYON-FERMION SYSTEM--THE SURFACE LAGRANGIAN AND GAUGE INVARIANT CHARGE CURRENT

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 10 No 1, Jan 86 pp 15-23

[English abstract of article by Zhang Yuezhong [1728 6460 0022] of Sichuan University]

[Text] By means of the surface Lagrangian and gauge invariant charge current, we present a detailed discussion of the physical meaning of each quantity in the boundary condition of dyon-fermion dynamics. It is shown that adding the surface Lagrangian to the system is equivalent to selecting a suitable boundary condition. By gauge transforming the Lagrangian by a charge generator, we get a corresponding U(1) charge current density which is both gauge invariant and spherosymmetrical. Use of the canonical method and careful treatment of surface terms show that the S-wave Hamiltonian given by Yamagishi requires amendment by a surface energy term.

PARTICLE DENSITIES AT THE CENTER REGION IN HIGH ENERGY HEAVY-ION COLLISIONS

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 10 No 1, Jan 86 pp 57-62

[English abstract of article by Lu Shiqi [4151 0013 3825] and Zhao Weiqin [6392 4850 0530] of the Institute of High Energy Physics, Chinese Academy of Sciences]

[Text] Based on the two-chain model by A. Capella, et al., the rapidity distributions of the multiplicity in high energy heavy-ion collisions, especially in head-on collisions, are discussed. The energy density at the center region in head-on collisions is estimated for different incident energies and different heavy ions. It is shown that the condition of the phase transition to the quark-gluon plasma can be realized in heavy-ion collisions at several tens of GeV.

STUDY OF α-EMISSION INDUCED BY ^{16}O ON ^{27}Al

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 10 No 1, Jan 86 pp 63-67

[English abstract of article by Zhan Wenlong [6124 2429 7893] and Shen Wenqing [3088 2429 1987], et al., of the Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou]

[Text] The α-particles induced by 84.5 MeV and 62 MeV ^{16}O on ^{27}Al are measured using a ΔE-E semiconductor telescope. The energy spectra, angular distributions, contour plot of $d^2\sigma/d\Omega dE$ in the E-θ plane of the emitted α particles and the variation of the nuclear temperature with the emission angles are obtained. The mechanism of the direct α particles is discussed.

INFLUENCE OF THE NEUTRON NUMBER OF TARGET NUCLEUS ON CROSS SECTIONS OF PARTICLE EMISSION IN $^{12}C+^{112,124}Sn$

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 10 No 1, Jan 86 pp 68-74

[English abstract of article by Wang Dayan [3769 1129 1693], Jin Genming [7246 2704 2494] and Zhang Li [1728 4539], et al., of the Institute of Modern Physics, Chinese Academy of Sciences]

[Text] The energy spectra and angular distributions of Li, Be and B particles emitted from the $^{12}C+^{112}Sn$ and $^{12}C+^{124}Sn$ reactions at E_L = 70.0 MeV are measured. The angular distributions of the Li, Be and B particles are found to be peaked around the grazing angle, without any forward peaked component.

The experimental results also show that the cross section for emission is larger in the $^{12}C+^{112}Sn$ reaction than in the $^{12}C+^{124}Sn$ reaction, in contrast to the cross sections for Li, Be and B emissions. This indicates the effect of the neutron number of the target nucleus on the emission probability.

PROTON AND NEUTRON SUBSHELLS AND THE INTERPLAY BETWEEN THEM. II. RARE EARTH REGION

Beijing GAONENG WULI YU HE WULI [PHYSICA ENERGIAE FORTIS ET PHYSICA NUCLEARIS] in Chinese Vol 10 No 1, Jan 86 pp 92-97

[English abstract of article by Zhang Jingye [1728 2417 2814] and Li Baoan [2621 1405 1344], et al., of the Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou; and Zhang Mengzhong [1728 1125 0022] of Lanzhou University]

[Text] Based on the experimental data of even-even nuclei in the rare earth region, further study of the interplay between subshells of two kinds of nucleons has been carried out. Emphasis is placed on the characteristics and N, I dependence of the Z=64 subshell. A theoretical explanation is given in terms of the Nilsson diagram and a simplified calculation of n-p interactions.

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